CAPITAL CENTER IMPROVEMENT & RENOVATIONS

SECTION 08 00 00

DOOR AND FRAME SCHEDULE

OPENING				DOOR						FRAME				REMARKS
MARK	ROOM NAME	SIZE	SET	LABEL	TYPE	MAT	INT. FIN.	EXT. FIN.	GLAZING	MAT	TYPE	INT.FIN.	EXT.FIN.	PHASE
O3 a	OFFICE	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	AA	PT	PT	
O5 a	CORRIDOR	(2) 3'-0" x 7'-0"	O1	NR	B	HM	PT	PT	SG-CT	HM	AA	PT	PT	
21 a	OFFICE	3'-0" x 7'-0"	O8	NR	A	WD	PL	PL		HM	CC	PT	PT	
21 b	OFFICE	3'-0" x 7'-0"	O8	NR	A	WD	PL	PL		HM	CC	PT	PT	
24 a	CORRIDOR	(2) 3'-0" x 7'-0"	O2	90	B	HM	PT	PT	SG-CT	HM	AA	PT	PT	
27 a	CORRIDOR	(2) 3'-0" x 7'-0"	O2	90	B	HM	PT	PT	SG-CT	HM	AA	PT	PT	
1002 a	WORKROOM	3'-0" x 7'-0"	O8	NR	B	HM	PT	PT	SG-CT	HM	AA	PT	PT	
1002 b	IT DATA	(2) 3'-0" x 7'-0"	23	NR	B	HM	PT	PT	SG-CT	HM	AA	PT	PT	
1046 a	RESTROOM	3'-0" x 7'-0"	O4	NR	A	WD	PL	PL		HM	AA	PT	PT	
1104 a	RESTROOM	3'-0" x 7'-0"	O4	NR	A	WD	PL	PL		HM	AA	PT	PT	
1105 b	***IT ROOM***	***3'-0" x 7'-0"***	***O5***	***NR***	***A***	***HM***	***PT***	***PT***		***HM***	***AA***	***PT***	***PT***	
1504 a	RESTROOM	3'-0" x 7'-0"	O4	NR	A	WD	PL	PL		HM	AA	PT	PT	
1505 a	RESTROOM	3'-0" x 7'-0"	O4	NR	A	WD	PL	PL		HM	AA	PT	PT	
1506 z	MECHANICAL	3'-0" x 7'-0"	***O5A***	***45***	A	HM	PT	PT		HM	AA	PT	PT	
1509 a	CLASSROOM	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	AA	PT	PT	
1509 b	STORAGE	3'-0" x 7'-0"	15	NR	A	WD	PL	PL		HM	AA	PT	PT	
1509 c	CLASSROOM	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	AA	PT	PT	
1513 b	CLASSROOM	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	BB	PT	PT	
1513 h	OFFICE	3'-0" x 7'-0"	O8	NR	A	WD	PL	PL		HM	CC	PT	PT	
1513 n	WORKROOM	3'-0" x 7'-0"	O8	NR	B	HM	PT	PT	SG-CT	HM	AA	PT	PT	
1513 o	RESTROOM	3'-0" x 7'-0"	11	NR	A	WD	PL	PL		HM	AA	PT	PT	
1513 t	CLASSROOM	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	BB	PT	PT	
1522 a	CLASSROOM	3'-0" x 7'-0"	12	NR	A	WD	PL	PL		HM	AA	PT	PT	
1522 b	DEMO KITCHEN	3'-0" x 7'-0"	***12A***	NR	A	WD	PL	PL		HM	AA	PT	PT	
1522 c	L.S. CLASSROOM	3'-0" x 7'-0"	***12A***	NR	A	WD	PL	PL		HM	AA	PT	PT	
1522 d	L.S. CLASSROOM	3'-0" x 7'-0"	O7	NR	A	WD	PL	PL		HM	AA	PT	PT	
1522 e	MEETING RM	3'-0" x 7'-0"	***12B***	***90***	B	WD	PL	PL	SG-CT	HM	AA	PT	PT	
1522 g	MEETING RM	3'-0" x 7'-0"	***12A***	NR	B	WD	PL	PL	SG-CT	HM	AA	PT	PT	
1529 a	RESTROOM	3'-0" x 7'-0"	O9	NR	A	WD	PL	PL		HM	AA	PT	PT	
1529 b	CUSTODIAL	3'-0" x 7'-0"	O5	NR	A	HM	PT	PT		HM	AA	PT	PT	
1529 c	RESTROOM	3'-0" x 7'-0"	O4	NR	A	WD	PL	PL		HM	AA	PT	PT	
1529 d	RESTROOM	3'-0" x 7'-0"	O4	NR	A	WD	PL	PL		HM	AA	PT	PT	
1533 a	L.S. CLASSROOM	3'-0" x 7'-0"	***12A***	NR	A	WD	PL	PL		HM	AA	PT	PT	
1600 a	AUDITORIUM	(2)3'-0" x 7'-0"	O3	NR	B	WD	PL	PL	SG-CT	HM	AA	PT	PT	
1602 a	STORAGE	3'-0" x 7'-0"	O5	NR	A	WD	PL	PL		HM	AA	PT	PT	
1603 a	COMPUTER LAB	3'-0" x 7'-0"	***12A***	NR	A	WD	PL	PL		HM	BB	PT	PT	
1604 a	COMPUTER LAB	3'-0" x 7'-0"	***12A***	NR	A	WD	PL	PL		HM	BB	PT	PT	
1605 a	IDF	3'-0" x 7'-0"	O5	NR	A	HM	PT	PT		HM	AA	PT	PT	
1606 a	OFFICE	3'-0" x 7'-0"	O8	NR	A	WD	PL	PL		HM	CC	PT	PT	
1607 a	OFFICE	3'-0" x 7'-0"	O8	NR	A	WD	PL	PL		HM	CC	PT	PT	

CAPITAL CENTER IMPROVEMENT & RENOVATIONS

SECTION 08 00 00

DOOR AND FRAME SCHEDULE

1608 a	WORK ROOM	3'-0" x 7'-0"	O8	NR	A	WD	PL	PL		HM	AA	PT	PT	
1609 a	STAFF RESTROOM	3'-0" x 7'-0"	11	NR	A	WD	PL	PL		HM	AA	PT	PT	
1610 a	CLASSROOM	3'-0" x 7'-0"	12	NR	A	WD	PL	PL		HM	BB	PT	PT	
1610 b	CLASSROOM	3'-0" x 7'-0"	13	NR	A	HM	PT	PL		HM	AA	PT	PT	
1610 c	CLASSROOM	2'-0"" x 7'-0"	13	NR	A	HM	PT	PT		HM	AA	PT	PT	
1611 a	CLASSROOM	3'-0" x 7'-0"	12	NR	A	WD	PL	PT		HM	BB	PT	PT	
1611 b	CLASSROOM	3'-0" x 7'-0"	12	NR	A	WD	PL	PL		HM	BB	PT	PT	
1611 c	CLASSROOM	(2)1'-6" x 7'-0"	14	NR	A	HM	PT	PT		HM	AA	PT	PT	
1612 a	CLASSROOM	3'-0" x 7'-0"	12	NR	A	WD	PL	PL		HM	BB	PT	PT	
1612 b	CLASSROOM	3'-0" x 7'-0"	13	NR	A	HM	PT	PT		HM	AA	PT	PT	
1612 c	CLASSROOM	2'-0"" x 7'-0"	13	NR	A	HM	PT	PT		HM	AA	PT	PT	
1613 a	CLASSROOM	3'-0" x 7'-0"	12	NR	A	WD	PL	PL		HM	BB	PT	PT	
1613 b	CLASSROOM	3'-0" x 7'-0"	12	NR	A	WD	PL	PL		HM	BB	PT	PT	
1613 c	CLASSROOM	(2)1'-6" x 7'-0"	14	NR	A	HM	PT	PT		HM	AA	PT	PT	
1614 a	GEN. STORAGE	3'-0" x 7'-0"	15	NR	A	WD	PL	PL		HM	AA	PT	PT	
1615 a	PREP ROOM	3'-0" x 7'-0"	16	NR	A	HM	PT	PT		HM	AA	PT	PT	
1616 a	SCIENCE LAB	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	BB	PT	PT	
1616 b	SCIENCE LAB	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	BB	PT	PT	
1616 c	SCIENCE LAB	3'-0" x 7'-0"	O8	NR	B	WD	PL	PL	SG-CT	HM	AA	PT	PT	
1617 a	CLASSROOM	3'-0" x 7'-0"	12	NR	A	WD	PL	PL		HM	BB	PT	PT	
1617 b	CLASSROOM	3'-0" x 7'-0"	12	NR	A	WD	PL	PL		HM	BB	PT	PT	
1617 c	CLASSROOM	(2)1'-6" x 7'-0"	14	NR	A	HM	PT	PT		HM	AA	PT	PT	
1618 a	SCIENCE LAB	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	AA	PT	PT	
1618 b	SCIENCE LAB	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	BB	PT	PT	
1618 c	SCIENCE LAB	3'-0" x 7'-0"	O8	NR	B	WD	PL	PL	SG-CT	HM	BB	PT	PT	
1619 a	PREP ROOM	3'-0" x 7'-0"	19	NR	A	HM	PT	PT		HM	AA	PT	PT	
1620 a	CHEM STORAGE	3'-0" x 7'-0"	20	S	A	HM	PT	PT		HM	AA	PT	PT	
1621 a	SCIENCE LAB	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	BB	PT	PT	
1621 b	SCIENCE LAB	3'-0" x 7'-0"	O6	NR	A	WD	PL	PL		HM	BB	PT	PT	
1621 c	SCIENCE LAB	3'-0" x 7'-0"	O8	NR	B	WD	PL	PL	SG-CT	HM	AA	PT	PT	
1622 a	ELECTRICAL	3'-6" x 7'-0"	21	90	A	HM	PT	PT		HM	AA	PT	PT	

Notes:

SG	Safety Glass
CT	Clear Tempered
PT	Painted
PL	Plastic Laminate
NR	No Rating
S	Smoke
WD	Wood
HM	Hollow Metal

PART 1 - GENERAL

1.01 REFERENCES

A. BHMA A156.18 - American National Standard for Materials and Finishes; Builders Hardware Manufacturers Association, Inc.; 2000 (ANSI/BHMA A156.18).

B. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association; 1999.

C. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

1.02 QUALITY ASSURANCE

A. Special Requirements of Regulatory Agencies
   1. Hardware at Labeled Openings: Furnish hardware in accordance with NFPA Standard No. 80 for fire-rated opening. In case of conflict between type of hardware specified and type required for fire protection, furnish type required.
      a. Furnish hardware of type listed by UL for usage with types and sizes of fire doors and frames required.
      b. Unless otherwise indicated, arrange doors at fire-rated openings to remain in normally closed position by furnishing each unit with automatic closing device.
      c. Furnish active latch bolts, of UL approved throw that cannot be held in retracted position.
   2. Single Source: Where several manufacturers are specified for one type of hardware, use only products of one manufacturer.
   3. Supplier’s Qualifications:
      a. Hardware supplier shall have and maintain a factory direct status with all manufacturer’s specified or approved during the course of the project for superior product knowledge and quick lead-time response.
      b. Supplier shall employ an Architectural Hardware Consultant (AHC) who will coordinate and produce required submittals and who is available during the course of the project for meetings with the Architect and Owner.

1.03 PRE-INSTALLATION CONFERENCE

A. Prior to commencement of hardware work, schedule meeting at mutually agreeable time to include, Owner, Contractor, Contractor's field superintendent, hardware installer, and other interested parties to review methods and procedures to be used to achieve end results.

1.04 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Product Data
   1. Hardware: Manufacturer's specifications, maintenance and keying manual, and installation instructions of finish hardware. Include photographs, marked templates

and other data required to show compliance with these specifications.

C. Hardware Schedule: List manufacturer's name with manufacturer's hardware number together with finishes designation. Include separate schedule of key and masterkey system. Owner's review shall not relieve Contractor of responsibility from requirement to provide complete hardware for project.

D. Wiring Diagrams: Furnish elevations and point to point wiring diagrams for each opening with hard-wired electrified door hardware. Diagrams shall be submitted with the finish hardware schedule.

E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

F. Keying: Meet with Owner to determine specific keying and submit a written keying schedule for Owner approval within 10 days of meeting.

G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Templates: After hardware schedule has been approved, furnish templates as soon as possible.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for requirements applicable to fire rated doors and frames.

1.06 DELIVERY

A. Delivery of Hardware: Deliver in unopened containers fully identified with manufacturer's name, number and finish.

B. Delivery of Keys: Master keys and all high-security or restricted keyway blanks shall be sealed in tamper-proof packaged boxes when shipped from the factory. The boxes shall be shrink wrapped and imprinted to ensure the integrity of the packaging. Ship permanent keys, key blanks and cores directly to the Owner’s representative.

1.07 COORDINATION

A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

B. Furnish templates for door and frame preparation.

C. Furnish elevations and point to point wiring diagrams.

D. Coordinate Owner's keying requirements during the course of the Work.

1.08 WARRANTY

A. Warrant door closers and component parts against mechanical failure for period of 10 years, locksets for 7 years and exit devices for 3 years. All other products are to carry the standard building warranty.

B. Upon notification of defects within warranty period, make necessary repairs and replacements at Owner's convenience.

1.09 MAINTENANCE PRODUCTS

A. Provide maintenance tools and accessories supplied by hardware component manufacturer.

B. Maintenance Material: Deliver to Owner at project site the following items:
   1. Provide special wrenches and tools applicable to each different or special hardware component.

C. One set of Maintenance Manuals for locksets, closers and exit devices.

1.10 CLOSEOUT SUBMITTALS

A. As specified in Section 01 77 00.

B. Keys: Furnish as per 087100,

C. Operation and maintenance data for review and approval.
   1. Operation and maintenance data for hardware.
   2. Final typed finish hardware schedule that includes any corrections and changes to the submittal schedule.

PART 2 - PRODUCTS

NOTE:

- NO CLASSROOM FUNCTION LOCKS. USE ND92 AT TYPICAL MULTIPLE OCCUPANT OFFICES.
- CONTRACTOR TO PROVIDED .25" SHIMS FOR MULLION STORAGE KITS.
- AT PAIRS WITH PANIC HARDWARE USE ONLY ONE ACTIVE TRIM.
- INTERIOR PANIC DEVICES TO HAVE LEVER TRIM, NOT NL OR DT.
- "E KEYWAY"

HW SET:01

DOOR NUMBER:
05A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	KEYED REMOVABLE MULLION	KR4954-STAB	689	VON
1	EA	PANIC HARDWARE	99-EO	626	VON
1	EA	FIRE EXIT HARDWARE	99-L-F-06	626	VON
1	EA	MULLION STORAGE KIT	MT54 MULLION STORAGE KIT (REINFORCEMENT REQUIRED)	689	VON
1	EA	RIM CYLINDER	20-057-ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061-ICX	626	SCH
2	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH

2	EA	SURFACE CLOSER	4111 EDA WMS	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
4	EA	SILENCER	SR64	GRY	IVE

NOTE: CONTRACTOR TO FABRICATE AND PROVIDE .25" SPACER AT TOP OF MT54 MOUNTING KIT TO ADD NEEDED CLEARANCE FROM WALL.

HW SET:02

DOOR NUMBER:
024A 27A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	KEYED FIRE RATED REMOVABLE MULLION	KR9954-STAB	689	VON
1	EA	FIRE EXIT HARDWARE	99-EO-F	626	VON
1	EA	FIRE EXIT HARDWARE	99-L-F-2SI-06	626	VON
1	EA	MULLION STORAGE KIT	MT54 MULLION STORAGE KIT (REINFORCEMENT REQUIRED)	689	VON
2	EA	RIM CYLINDER	20-057-ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061-ICX	626	SCH
3	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
2	EA	SURFACE CLOSER	4111 EDA WMS	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
	EA	MULLION SEAL	5110	BLK	PEM
1	SET	SEALS	S88D	DKB	PEM

NOTE: CONTRACTOR TO FABRICATE AND PROVIDE .25" SPACER AT TOP OF MT54 MOUNTING KIT TO ADD NEEDED CLEARANCE FROM WALL.

HW SET:03

DOOR NUMBER:
1600A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	KEYED REMOVABLE MULLION	KR4954-STAB	689	VON
1	EA	PANIC HARDWARE	LD-99-EO	626	VON
1	EA	PANIC HARDWARE	LD-99-L-2SI-06	626	VON
1	EA	MULLION STORAGE KIT	MT54 MULLION STORAGE KIT (REINFORCEMENT REQUIRED)	689	VON
2	EA	RIM CYLINDER	20-057-ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061-ICX	626	SCH
3	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
2	EA	SURFACE CLOSER	4111 EDA WMS	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
4	EA	SILENCER	SR64	GRY	IVE

NOTE: CONTRACTOR TO FABRICATE AND PROVIDE .25" SPACER AT TOP OF MT54 MOUNTING KIT TO ADD NEEDED CLEARANCE FROM WALL.

HW SET:04

DOOR NUMBER:
1046A 1104A 1504A 1505A 1529C 1529D

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM DEADBOLT	B663T	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	PUSH PLATE	8200 4" X 16" CFC	630	IVE
1	EA	PULL PLATE	8302 6" 4" X 16" CFT G	630	IVE
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET:05

DOOR NUMBER:

1105B 1529B 1602A 1605A
1506Z

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET:05A

DOOR NUMBER:
1506Z

EACH TO HAVE:

QTY		***DESCRIPTION***	***CATALOG NUMBER***	***FINISH***	***MFR***
3	***EA***	***HW HINGE***	***5BB1HW 4.5 X 4.5 NRP***	***652***	***IVE***
1	***EA***	***FIRE EXIT HARDWARE***	***99-L-NL-F-06***	***626***	***VON***
1	***EA***	***RIM CYLINDER***	***20-057-ICX***	***626***	***SCH***
1	***EA***	***PERMANENT CORE***	***23-030 E KEYWAY***	***626***	***SCH***
1	***EA***	***SURFACE CLOSER***	***4111 EDA TBWMS***	***689***	***LCN***
1	***EA***	***KICK PLATE***	***8400 10" X 2" LDW B4E***	***630***	***IVE***
1	***EA***	***WALL STOP***	***WS406/407CVX (REINFORCING REQUIRED)***	***630***	***IVE***
1	***SET***	***SEALS***	***S88D***	***DKB***	***PEM***

HW SET:06

DOOR NUMBER:

03A 1509A 1509C 1513B 1513T 1616A
1616B 1618A 1618B 1621A 1621B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	99-L-F-2SI-06-SNB	626	VON
2	EA	RIM CYLINDER	20-057-ICX	626	SCH
2	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH

1	EA	SURFACE CLOSER	4111 EDA WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET:07

DOOR NUMBER:
1522D

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PRIVACY LOCK WITH OCCUPIED INDICATOR	L9456T 06A L583-363 L283-722	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
1	SET	SEALS	S88D	DKB	PEM

HW SET:08

DOOR NUMBER:

1002A	1513H	1513N	1606A	1607A	1608A
1616C	1618C	1621C	21A	21B	

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL ENTRANCE LOCK	ND92TD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET:09

DOOR NUMBER:
1529A

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR

3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PRIVACY LOCK WITH OCCUPIED INDICATOR	L9456T 06A L583-363 L283-722	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
1	SET	SEALS	S88D	DKB	PEM

HW SET:10- NOT USED

HW SET:11

DOOR NUMBER:
1513O 1609A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	STAFF PRIVACY LOCK WITH OCCUPIED INDICATOR	L9485T 06A L583-363 L283-722	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
1	SET	SEALS	S88D	DKB	PEM

HW SET:12

DOOR NUMBER:

1522A	1522B	1522C	1522E	1522G	1533A
1603A	1604A	1610A	1611A	1611B	1612A
1613A	1613B	1617A	1617B		

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL CLASSROOM SEC	ND95TD RHO	626	SCH

2	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	WALL STOP	WS447 (SEE NOTE BELOW)	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

NOTE: CONTRACTOR TO PROVIDE REINFORCEMENT FOR WALL STOP. MOUNT WALL STOP AS HIGH AS POSSIBLE TO MAKE CONTACT WITH OUTBOARD UPPER EDGE OF DOOR.

HW SET:12A

DOOR NUMBER:
1522B 1522C 1522G 1533A 1603A 1604A

EACH TO HAVE:

QTY		*DESCRIPTION*	*CATALOG NUMBER*	*FINISH*	*MFR*
3	*EA*	*HW HINGE*	*5BB1HW 4.5 X 4.5 NRP*	*652*	*IVE*
1	*EA*	*PANIC HARDWARE*	*LD-99-L-2SI-06*	*626*	*VON*
2	*EA*	*RIM CYLINDER*	*20-057-ICX*	*626*	*SCH*
2	*EA*	*PERMANENT CORE*	*23-030 E KEYWAY*	*626*	*SCH*
1	*EA*	*SURFACE CLOSER*	*4111 EDA TBWMS*	*689*	*LCN*
1	*EA*	*KICK PLATE*	*8400 10" X 2" LDW B4E*	*630*	*IVE*
1	*EA*	*WALL STOP*	*WS447* *(SEE NOTE BELOW)*	*626*	*IVE*
3	*EA*	*SILENCER*	*SR64*	*GRY*	*IVE*

NOTE: CONTRACTOR TO PROVIDE REINFORCEMENT FOR WALL STOP. MOUNT WALL STOP AS HIGH AS POSSIBLE TO MAKE CONTACT WITH OUTBOARD UPPER EDGE OF DOOR.

HW SET:12B

DOOR NUMBER:
1522E

EACH TO HAVE:

QTY		*DESCRIPTION*	*CATALOG NUMBER*	*FINISH*	*MFR*
3	*EA*	*HW HINGE*	*5BB1HW 4.5 X 4.5 NRP*	*652*	*IVE*
1	*EA*	*FIRE EXIT HARDWARE*	*99-L-F-2SI-06*	*626*	*VON*
2	*EA*	*RIM CYLINDER*	*20-057-ICX*	*626*	*SCH*
2	*EA*	*PERMANENT CORE*	*23-030 E KEYWAY*	*626*	*SCH*
1	*EA*	*SURFACE CLOSER*	*4111 EDA TBWMS*	*689*	*LCN*
1	*EA*	*KICK PLATE*	*8400 10" X 2" LDW B4E*	*630*	*IVE*
1	*EA*	*WALL STOP*	*WS447* *(SEE NOTE BELOW)*	*626*	*IVE*
1	*SET*	*SEALS*	*S88D*	*DKB*	*PEM*

NOTE: CONTRACTOR TO PROVIDE REINFORCEMENT FOR WALL STOP. MOUNT WALL STOP AS HIGH AS POSSIBLE TO MAKE CONTACT WITH OUTBOARD UPPER EDGE OF DOOR.

HW SET:13

DOOR NUMBER:
1610B 1610C 1612B 1612C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET:14

DOOR NUMBER:
1611C 1613C 1617C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458 (12" BOTTOM X 24" TOP BOLT)	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
2	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
4	EA	SILENCER	SR64	GRY	IVE

NOTE: DUST PROOF STRIKE MUST BE INSTALLED INTO FLOOR. DO NOT OMIT.

HW SET:15

DOOR NUMBER:
1509B 1614A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE

1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET:16

DOOR NUMBER:
1615A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	OH STOP	100S ADJ	630	GLY
1	EA	SURFACE CLOSER	4011 TBWMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET:17- NOT USED

HW SET:18- NOT USED

HW SET:19

DOOR NUMBER:
1619A

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR

3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	OH STOP	100S ADJ	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HW SET:20

DOOR NUMBER:
1620A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	OH STOP	100S ADJ	630	GLY
1	EA	SURFACE CLOSER	4111 EDA WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	SET	SEALS	S88D	DKB	PEM

HW SET:21

DOOR NUMBER:
1622A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	99-L-F-2SI-06-SNB	626	VON
2	EA	RIM CYLINDER	20-057-ICX	626	SCH
2	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
1	EA	SURFACE CLOSER	4111 EDA WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
1	SET	SEALS	S88D	DKB	PEM

HW SET:22- NOT USED

HW SET:23

DOOR NUMBER:

1002B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	KEYED REMOVABLE MULLION	KR4954-STAB	689	VON
1	EA	PANIC HARDWARE	LD-99-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-99-L-NL-06	626	VON
1	EA	MULLION STORAGE KIT	MT54 MULLION STORAGE KIT (REINFORCEMENT REQUIRED)	689	VON
1	EA	RIM CYLINDER	20-057-ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061-ICX	626	SCH
2	EA	PERMANENT CORE	23-030 E KEYWAY	626	SCH
2	EA	SURFACE CLOSER	4111 EDA WMS	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CVX (REINFORCING REQUIRED)	630	IVE
4	EA	SILENCER	SR64	GRY	IVE
1	EA	POWER SUPPLY	PS902 900-BBK	LGR	SCE
			ACCESS CONTROL - WORK OF DIVISION 28		
			DOOR CONTACT(S) - WORK OF DIVISION 28		
			(PREP DOOR(S) AND FRAME)		
1			PROVIDE FACTORY POINT TO POINT WIRING DIAGRAMS		
1			PROVIDE RISER DIAGRAMS		

NOTE: 120VAC TO POWER SUPPLY. HOME RUN FROM POWER SUPPLY TO QEL DEVICE AS FOLLOWS: 200FT/18 AWG, 320FT/16 AWG, 500FT/14 AWG, OR 800FT/12 AWG.

END OF SECTION

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.02 SUBMITTALS

A. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

B. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

A. Electric Appliances: Listed and labeled by UL and complying with NEMA standards.

1.04 WARRANTY

A. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

B. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

C. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.01 LIFE SKILL ROOM 1522C APPLIANCES

A. Provide all equipment in same color.

B. Refrigerator, Free Standing: Free-standing, ***side by side,*** frost-free.(Quantity 1)
   1. Capacity: Total minimum storage of ***20*** cubic ft; capacity.
   2. Size: ***30"*** wide.
   3. Energy Usage: Energy Star rated, ADA accessible.
   4. Finish: To be selected from standard color range after bid.
   5. Manufacturers:
      a. ***GE Appliances; Product GSS20ETHWW***: www.geappliances.com.
      b. or approved meeting specified requirements

C. Microwave: (Quantity 1)
   1. Capacity: 1.7 cubic ft.
   2. Size: 30" wide by 16-1/2" high by 15-1/4" deep.
   3. Power: Microwave wattage of 1000 watts.
   4. Features: Include turntable, cook top light, and 2-speed exhaust fan with provision for connection to exterior venting, turntable on/off control, sensor heating controls.

5. Finish: To be selected from standard color range after bid.
6. Manufacturers:
   a. GE Appliances; Product JVM1750SPSS: www.geappliances.com.
   b. or approved meeting specified requirements.

D. Dishwasher: Undercounter 32" high, ADA accessible. (Quantity, where indicated on drawings)
1. Finish: To be selected from standard color range after bid.
2. Manufacturers:
   a. GE Appliances; Product #GLDA696PSS: www.geappliances.com.
   b. Substitutions: See Section 01 25 13 - Product Requirements.

E. Range and Hood. (Quantity 1)
1. Finish: To be selected from standard color range after bid.
2. Manufacturers:
   a. ***GE Appliances; Product PS920SFSS***: www.geappliances.com.
   b. Substitutions: See Section 01 25 13 - Product Requirements.
   c. Refer to Demonstration Kitchen Classroom 1522B for Hood.

E. Washer and Dryer. (Quantity 1each)
1. Finish: To be selected from standard color range after bid.
2. Manufacturers:
   a. Whirlpool Duet Washer Appliances; Product #WFW87HEDW:
   b. Whirlpool Duet Dryer Appliances; Product #WED87HEDW:
   c. Substitutions: See Section 01 25 13 - Product Requirements.

2.02 DEMONSTRATION KITCHEN ROOM 1522B APPLIANCES

A. SUBSTITUTIONS
1. All equipment and materials for this section shall be provided as specified and as indicated on the drawings. Substitution requests may be submitted for approval in accordance with requirements specified in division 1, and to reach Architect at least 5 working days prior to bid submission dates.
2. Only those products deemed to be equal in quality, capacity, utility requirements, dimensions and operation for this project will be considered.

B. WORK TABLE (1 REQ'D)
1. Pacific Stainless Products Model WKT11436IS-MOD

C. PREP SINK (1 REQ'D)
1. Custom

D. FAUCET (1 REQ'D)
1. T&S Brass Model B-0231

E. WORK TABLE (1 REQ'D)
1. John Boos Model EFT8-3018

F. RANGE, 36", 6 ROUND SOLID BURNERS (1 REQ'D)
1. Imperial Model IR-6-E

F. TYPE 2 VAPOR HOOD (See item G)

G. HOOD TO CEILING CLOSURE

H. EXHAUST DUCT AND FAN

I. WORK TABLE (1 REQ'D)
1. John Boos Model ST6R5-3036SSK-X

J. MICROWAVE SHELF (1 REQ'D)
1. John Boos Model EBMS6-2024-X

K. MICROWAVE OVEN (1 REQ'D)
1. Panasonic Model NE-1054F

L. REACH-IN REFRIGERATOR (1 REQ'D)
1. True Food Service Equipment Model T-19

M. REACH-IN FREEZER (1 REQ'D)
1. True Food Service Equipment Model T-19F

N. SHELVING, WALL-MOUNTED (1 REQ'D)
1. John Boos Model BHS1224

O. CLEAN DISHTABLE (1 REQ'D)
1. John Boos Model JDTC-20-36L-X

P. DISHWASHER, DOOR TYPE (1 REQ'D)
1. CMA Dishmachines Model EST-C

Q. PRE-RINSE (1 REQ'D)
1. T&S Brass Model B-0133-ADF06

R. DISHTABLE SORTING SHELF (1 REQ'D)
1. John Boos Model PB-SRW-21-X

S. SOILED DISHTABLE (1 REQ'D)

1. John Boos Model JDTS-20-48R-X

2.03 PRODUCT REQUIREMENTS

A. Dish tables and drain boards: Fabricate of 14-gauge stainless steel, with exposed edges formed into 1-1/2" by 190- degree rolled rim approximately 3" high. Provide built-in pitch of 1/2" minimum. Provide 10"-high backsplashes with 2" return on 45-degree angle as indicated. Construct front rim and backsplash on drain boards with continuous level plane with sink it adjoins. Support drain boards up to 36" in length by 1"-diameter stainless steel tube welded to underside of drain board and leg gusset. Support drain boards 36" and longer with legs. Cove horizontal and vertical corners with not less than 3/4" radius. Apply sound deaden to underside.
B. Framing: Mount table tops on 4" wide by 1 ½" 14-gauge galvanized channels. Mount dish tables and drain boards on 4" wide x 1 ½" 14-gauge stainless steel channels.
C. Table Tops: Fabricate of single thickness material of no lighter than 14-gauge stainless steel, suitably reinforced with welded or separate supporting members for anchoring to bases or supporting frames, except where otherwise specified. Tops to have integrally formed splashes as required, nosings, and /or raised rims as detailed and specified, with all corners welded. Sound deaden underside of all custom fabricated stainless steel tops and sink bowls.
D. Legs and cross rails: Construct legs of 1-5/8" OD by 16-gauge stainless steel tubing, with fully enclosed stainless steel bullet shaped adjustable foot with minimum adjustment of 1" up or down without any threads showing. Weld legs to 4" high stainless steel gusset with top completely sealed by means of stainless steel plate. Weld gusset continuously to bottom of unit framing.
E. Custom fabricated sinks: Sink compartments shall be fabricated with a minimum of ¾" diameter cove at all bottom and vertical corners, and sloped to drain. Sinks to be 14-gauge stainless steel unless specified otherwise.
F. Butt joints: Butt joints made by riveting straps under seams and then filled with solder will not be permitted or accepted.
G. Welding: Welding corners, joints, and connections shall be electrically welded and seamless, with joints invisible and welds free from pits, cracks, discolorations, and other mechanical imperfections. Welds shall be ground smooth and polished to match the original finish. Welding or soldering shall be of a non-toxic nature when used on working surfaces exposed to unpacked food.
H. Wall Shelves: Fabricate of 16-gauge stainless steel with back turned up 2", feathered slightly to wall to ensure a tight fit. Sides and front shall be turned down 90 deg. 1 ½" and back ½" at 15 deg. or as shown on plans. Angled shelf brackets shall be 14 gauge stainless steel and fastened to underside of shelves with studs and nuts. Brackets shall be spaced 48" O.C. maximum and shall be fastened to the wall through suitable wall backing or studs.
I. Sharp edges will not be accepted and shall be deburred, filed, or otherwise made smooth.
J. Metal openings and rims such as top openings for pipes shall be fitted with minimum 1/2" high raised watertight ferrules or fittings to prevent seepage.
K. Plumbing and electrical connections: all plumbing and electrical connections and trim are to be provided and installed by the plumbing or electrical contractor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are present and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING

A. Adjust operating equipment to efficient operation.

3.04 CLEANING

A. After completion of installation and other major work areas, remove protective coverings and clean food service equipment, internally and externally. Restore exposed and semi exposed finishes to remove abrasions and other damages; polish exposed metal surfaces and touch-up painted surfaces. Replace work that cannot be successfully restored.

3.5 CLOSEOUT PROCEDURES

A. Provide services of Installer's technical representative, and manufacturer's technical representative where required, to instruct Owner's personnel in operation and maintenance of equipment. Schedule training with Owner: provide at least 7 days notice to Owner of training date.
B. Final acceptance of equipment: The Architect will review the equipment and placement prior to final acceptance. Any deviations from the plans and specifications will be rejected and the Contractor shall promptly replace and execute his own work, which results from rejected materials as per the specifications as stated herein and at no expense to the owner.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Providing commercial electric commercial water heaters, expansion tanks and related appurtenances.

1.2 RELATED WORK

A. Basic Plumbing Requirements, Section 22 00 00.
B. General Duty Valves for Plumbing Piping, Section 22 05 23
C. Hangers and Supports for Plumbing Piping and Equipment, Section 22 05 29
D. Vibration and Seismic Control for Plumbing Piping and Equipment, Section 22 05 48
E. Identification for Plumbing Piping and Equipment, Section 22 05 53
F. Testing of Plumbing, Section 22 05 93
G. Plumbing Insulation, Section 22 07 00
H. Facility Water Distribution, Section 22 11 00
I. Commercial Plumbing Fixtures, Section 22 42 00

1.3 SUBMITTALS

A. Provide submittals in accordance with Section 22 00 00.
B. Submittals shall include: Manufacturer's catalog or technical data showing performance, dimensions, materials of construction. and recommended methods of installation.

1.4 OPERATION AND MAINTENANCE DATA

A. Provide O&M data in accordance with Section 22 00 00.
B. O&M data shall include:
   1. Manufacturer's literature.
   2. Maintenance instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Water Heaters: A.O. Smith, Rheem/Rhuud, Heat Transfer Products, Inc. or approved equal.
B. Expansion Tank: Amtrol, Bell & Gossett, Watts or approved equal.
C. Mixing Valves: Leonard or approved equal.

2.2 DESCRIPTION

A. Electric Water Heaters ***(WH-2 & WH-3):***
   1. Size water heater to provide adequate hot water service to building requirements.
   2. Glass lined tank with 3-year warranty, 150 psi working pressure rating.

3. Adjustable limit control.
4. Equip heater with magnesium anodes.
5. Baked enamel jacket, insulation to comply with applicable energy codes.
6. ASME rated temperature and pressure relief valve and drain valve.
7. Comply with State of Washington Energy Code.
8. See Drawings for size and capacity.

B. Expansion Tank: Diaphragm type, pre-charged, steel outer shell with polypropylene liner. Provide commercial model.
C. Mixing Valve: Provide mixing valve(s) as required to provide 120 degree Fahrenheit water to showers and lavatories.

PART 3 - EXECUTION

3.1 DESIGN

A. Provide water heater(s) of capacity to serve the building with its intended usage and occupancy. Provide hot water capacity and temperature to provide consistent hot water to building fixtures. Provide expansion tank(s) for water heater(s), sized for water heater(s) selected and building water pressure.
B. Install hot water heater(s) with expansion tank in location coordinated with Architect and the Architectural documents. Provide all interconnecting piping and fittings for a complete system. Provide freeze protection as required.
C. Size the hot water equipment per ASHRAE standards and in compliance with the State of Oregon Plumbing Specialty Code requirements and recommendations.

3.2 INSTALLATION

A. Install water heater(s) inside the building and provide all interconnecting piping and pumps for a complete system. Installation to be per manufacturer’s instructions.
B. Provide each water heater with an expansion tank
C. Pipe pressure/temperature relief valve to over floor drain.
D. Provide seismic bracing for water heater as required by local jurisdiction. Provide supplemental drawings and data to governing code jurisdiction as required.
E. Provide hot water circulation pump for fixtures more than 40 feet from water heater. See specification section 22 42 00.
F. Provide thermometer for domestic hot water supply. Marshalltown Model V-3 adjustable model with 3-1/2 inch dial, 50 to 250 F. range for hot water. Ashcroft, Marsh or approved equal.
G. Water heaters shall be set in position so that their access panels for internal components are accessible from the front.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Providing of all plumbing fixtures, fixture trim, floor drains, domestic hot water circulating pump, water filters, cleanouts, pressure reducing valves and appurtenances as shown or required.
   2. Product Certification: Provide only products certified for use in the State of Oregon.

1.2 RELATED WORK

A. Basic Plumbing Requirements, Section 22 00 00.
B. Sleeves and Inserts, Section 22 05 05.
C. Gauges for Plumbing, Section 22 05 19.
D. General Duty Valves for Plumbing Piping, Section 22 05 23.
E. Hangers and Supports for Plumbing Piping and Equipment, Section 22 05 29.
F. Facility Water Distribution, Section 22 11 00.
G. Facility Sanitary Sewerage, Section 22 13 00.
H. Testing of Plumbing, Section 22 05 93.

1.3 SUBMITTALS

A. Provide submittals in accordance with Section 22 00 00.
B. Submittals shall include manufacturer's catalog literature for all products used.

1.4 OPERATION AND MAINTENANCE DATA

A. Provide O&M data in accordance with Section 22 00 00.
B. O&M data shall include:
   1. Manufacturer's literature.
   2. Maintenance instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vitreous China Plumbing Fixtures: American Standard or Kohler
B. Stainless Steel Sinks: Elkay or Just.
C. Flush Valves: Sloan.
D. Fixture Trim: Chicago.
E. Service Sinks: Acorn, Fiat, Mustee or Stern Williams.
F. Emergency Showers: Haws, Bradley, Chicago or Speakman.
G. Toilet Seats: Bemis, Olsonite, Church or Beneke.
H. Drinking Fountains: Haws or Sunroc.
I. Reduced Pressure Backflow Preventer: Watts, Febco or approved equal.

J. Tempering Valves: Haws or approved equal.
K. Water Deionizers: Ameriwater or approved equal.
L. Grease Traps: Schier Products or approved equal.
M. Neutralization Trap: Schier Products or approved equal.
N. Roof Drains and Overflow Roof Drains: Jay R. Smith, Wade, Josam, Zurn, ***Sioux Chief*** or approved equal.
O. Floor Drains and Floor Sinks: Jay R. Smith, Wade, Josam, Zurn, ***Sioux Chief*** or approved equal.
P. Grease Trap: Schier Products or Camplas.
Q. Cleanouts: Jay R. Smith, Wade, Zurn or approved substitution.
R. Trap Priming Valves: Precision Plumbing Products, Sioux Chief, Josam, Wade, Watts or approved substitution.

2.2 DESCRIPTION:

A. Water Closet (WC-1):
1. Kohler "Wellcome" Model K-4350, white vitreous china, floor mounted, ADA compliant, 14-3/4 high rim, flush valve, 1.28 or 1.5 gallon flush, elongated bowl, siphon jet action, with water saving trim.
2. Sloan "Royal" model 111, diaphragm type, 1.5 gpf, flush valve, dual filtered by-pass, chloramine resistant rubber compounds, vandal resistant cap, ADA compliant handle, sweat solder adapter, cast set screw wall flange.
3. Church No. 9500SSCT, elongated white extra heavy duty plastic open front seat less cover with stainless steel hinge post and self-sustaining concealed check hinge.

B. Water Closet (WC-2):
1. Kohler "Highline" Fig. K-4405, white vitreous china, floor mounted, ADA compliant, 17 high rim, flush valve, 1.28 or 1.5 gallon flush, elongated bowl, siphon jet action, with water saving trim.
2. Sloan "Royal" model 111, diaphragm type, 1.5 gpf, flush valve, dual filtered by-pass, chloramine resistant rubber compounds, vandal resistant cap, ADA compliant handle, sweat solder adapter, cast set screw wall flange.
3. Church No. 9500SSCT, elongated white extra heavy duty plastic open front seat less cover with stainless steel hinge post and self-sustaining concealed check hinge.

C. Water Closet (WC-3):
1. Kohler "Wellworth" Model K-3475, white vitreous china, flush tank with trip lever on left side, elongated 14-1/2" high bowl, siphon jet action, 1.5 gpf, floor mounted.
2. Church No. 9500SSCT, elongated white extra heavy duty plastic open front seat less cover with stainless steel hinge post and self-sustaining concealed check hinge.

D. Lavatory (L-1):

1. Kohler "Greenwich" model K-2032, overall dimensions 20-3/4” x 18-1/4”, wall hung with model 64839 hanger, white vitreous china lavatory with front overflow, faucet ledge drilled for 4” centers.
2. Chicago model 802-VE2805-665, deck mounted chrome plated brass faucet, 4” integral spout
3. Pre-formed manufactured insulation kit for trap, waste and water supplies.
4. Chrome Plated brass grid drain.
5. Provide floor mounted wall carrier. Refer to Architectural drawings for ADA mounting height.

E. Lavatory (L-2):
1. Kohler "Greenwich" model K-2032, overall dimensions 20-3/4” x 18-1/4”, wall hung with model 64839 hanger, white vitreous china lavatory with front overflow, faucet ledge drilled for 4” centers.
2. Chicago model 802-VE2805-665, deck mounted chrome plated brass faucet, 4” integral spout
3. Pre-formed manufactured insulation kit for trap, waste and water supplies.
4. Chrome Plated brass grid drain.
5. Provide floor mounted wall carrier. Refer to Architectural drawings for ADA mounting height

F. Lavatory (L-3):
1. Kohler "Greenwich" model K-2032, overall dimensions 20-3/4” x 18-1/4”, wall hung with model 64839 hanger, white vitreous china lavatory with front overflow, faucet ledge drilled for 4” centers.
2. Chicago model 802-VCP, deck mounted chrome plated brass faucet, 4” integral spout
3. Pre-formed manufactured insulation kit for trap, waste and water supplies.
4. Chrome Plated brass grid drain.
5. Provide floor mounted wall carrier. Refer to Architectural drawings for ADA mounting height.

G. Sink (S-1):
1. Elkay “LRAD 2219” single bowl, 22”x19-1/2”x6”, self-rimming, 18 gauge stainless steel, rear faucet ledge with 4” centers hole punch to match faucet, fully undercoated with grid strainer.
2. Chicago Model 1100-GN2AE-317CP, deck mounted chrome plated brass faucet, cast swing spout, ADA wrist blade lever handles, vandal resistant, Chicago E3VP vandal resistant 2.2 gpm flow restricting aerator.
3. Pre-formed manufactured insulation kit for trap, waste and water supplies.

H. Sink (S-2):
1. Elkay “LRAD 2219” single bowl, 22”x19-1/2”x6”, self-rimming, 18 gauge stainless steel, rear faucet ledge with 4” centers hole punch to match faucet, fully undercoated with grid strainer.

2. Chicago Model 1100-GN2AE-317CP, deck mounted chrome plated brass faucet, cast swing spout, ADA wrist blade lever handles, vandal resistant, Chicago E3VP vandal resistant 2.2 gpm flow restricting aerator.
3. Pre-formed manufactured insulation kit for trap, waste and water supplies.

I. Sink (S-3):
1. Acid resistant sink basin integral to counter supplies with drain fitting, see architectural specifications. Provide Orion or equal tailpiece and piping to neutralization tank located below sink.
2. Chicago No. 930-369 CP: cast brass, chrome plated, deck mount laboratory faucet with vacuum breaker spout, 317 wrist blade handles,E7 Lab nozzle outlet.

J. Sink (S-4):
1. Acid resistant sink basin integral to counter supplies with drain fitting, see architectural specifications. Provide Orion or equal tailpiece and piping to neutralization tank located below sink.
2. Chicago No. 930-369 CP: cast brass, chrome plated, deck mount laboratory faucet with vacuum breaker spout, 317 wrist blade handles,E7 Lab nozzle outlet.

K. Sink (S-5):
1. Acid resistant sink basin integral to counter supplies with drain fitting, see architectural specifications. Provide Orion or equal tailpiece and piping to neutralization tank located below sink.
2. Chicago No. 930-369 CP: cast brass, chrome plated, deck mount laboratory faucet with vacuum breaker spout, 317 wrist blade handles,E7 Lab nozzle outlet.

L. Sink (S-6):
1. Florestone “Model FM utility sink” 23”x22”x14”deep, white fiberglass or molded stone, back faucet ledge field punched for 2 faucets with 4”centers, self standing with 4 heavy duty molded legs.
2. Chicago No. CF2411G501LC: deck mounted, chrome plated, 11”goose neck spout, lever handles, 4”centers.

M. Service Sink (SS-1):
1. Mustee Model 63M, 24”x24”x10 high, Durastone service sink.
2. Provide 36" flexible rubber hose and stainless steel wall bracket.
3. Chicago Fig. 897-RCF, rough chrome plated brass faucet with vacuum breaker spout, 3/4" hose thread outlet, pail hook with wall support and 369 handles.

N. Shower (SH-1):
1. Fiber-Fab #63 H1 LP: Three –piece shower, fiberglass, gel coat, 60” x 36” x 79-1/2” dimensions, including fold down seat, 1-1/4” diameter “L” shaped stainless steel grab bar, soap ledge, anti slip floor, with Low Profile Bottom, removable threshold and barrier free ramp.

2. Chicago, 1762-VOC: Chrome planted, brass, pressure balancing shower valve with ADA compliant handle.
3. Detla. 190253A, Brass body, ADA compliant lever handle, chrome plated diverter valve. 76226 brass, chrome plated shower arm with wall flange, RP28601 chrome plated 2.5 gpm showerhead, 060304A compination stainless steel slide/grab bar, 70" hose, hand shower head, vacuum breaker, wall supply elbow and flange.
4. Fiber-Fab V140NC: solid brass, polished chrome finish shower drain.

O. Drinking Fountain (DF-1):
1. Sunroc 3700, barrier free, dual height, wall mounted, front push button valve, stainless steel drinking fountain, hooded bubbler head, waste strainer, vandal-resistant bottom plate and two integral brackets for mounting. SF-0160 stainless steel ADA skirt.
2. Floor mounted wall carrier.

P. Gas Cock (GC-1): Chicago Model "Combo Valve and Turret" Fig. 980-909-GASCP, deckmount vandal resistant turret with one vandal resistant ball valves, E7TC removable serrated hose nozzle with check valve, gas button.

Q. Gas Cock (GC-2): Chicago Model "Combo Valve and Turret" Fig. 9981-909-GASCP, deckmount vandal resistant turret with two vandal resistant ball valves, two E7TC removable serrated hose nozzles with check valves and gas buttons.

R. Air Cock (AC-1): Chicago Model "Combo Valve and Turret" Fig. 980-909-AIRCP, deckmount vandal resistant turret with one vandal resistant ball valves, E7TC removable serrated hose nozzle with check valve, air button.

S. Air Cock (AC-2): Chicago Model "Combo Valve and Turret" Fig. 9981-909-AIRCP, deckmount vandal resistant turret with two vandal resistant ball valves, two E7TC removable serrated hose nozzles with check valves and air buttons.

T. Hose Bibb (HB-1): J.R. Smith, Model 5609QT, brass, close coupled hydrant with vacuum breaker and loose key handle. Designed to fit within a wall thickness of 4 inches.

U. Valve Box (VB-1): Guy Grey #MIB1AB, ¼ turn valve, 20 gauge, white powder coated box with face plate.

V. Water Deionizer (DI-1): Americwater, ½" inlet , 3/8" tub fitting outlet, 1 gpm, 22"x 5-1/2" x 27-1/2" , three 270 grain mex bed cartridges providing 15 megohm/cm water resistivity, water quality monitor light , wall bracket, installation ket and filter wrench.

W. Floor Drain (FD-1): Jay R. Smith Fig. 2005-02-A-NB-P050-U, Duco cast iron body, nickel bronze adjustable round strainer head, vandal proof screws, 2" outlet and trap primer connection.

X. Floor Drain (FD-2): Jay R. Smith Fig. 2005-02-A-NB-P050-U, Duco cast iron body, nickel bronze adjustable round strainer head, vandal proof screws, 2" outlet and trap primer connection and Fig. 3580 funnel.

Y. Floor Drain (FD-3): J.R. Smith, Fig. 2005-04-A-NB-P050, Duco cast iron body, nickel bronze adjustable round strainer head, trap primer connection, 4" outlet .

Z. Floor Sink (FS-1): J.R. Smith, Fig. 3100Y-12, Duco cast iron body, nickel bronze dome bottom strainer, 4" outlet, 10" deep, vandal proof screws, clamping ring for waterproof flooring and trap primer connection.

AA. Floor Sink (FS-2): J.R. Smith, Fig. 3100Y-12, Duco cast iron body, nickel bronze dome bottom strainer, 3" outlet, 8" deep, vandal proof screws, clamping ring for waterproof flooring and trap primer connection.

BB. Roof Drain (RD-1): J.R. Smith, Fig. 1010-C-R-U, Duco cast iron body, flashing clamp and gravel stop, sump receiver, underdeck clamp and vandal proof polyethylene dome. Size as noted on the drawings.

CC. Overflow Roof Drain (OFD-1): J.R. Smith Figure 1080-C-R-U, Duco cast iron body, 2" exterior water dam, flashing clamp and gravel stop, sump receiver, underdeck clamp and vandal-proof polyethylene dome. Size as noted on the drawings.

DD. Emergency Shower/Eyewash (ESH-1): Haws 8200WC.

EE. Tempering Valve (TV-1): Haws Model 9202.

FF. Emergency Eyewash: Haws Model 7610 WC.

GG. Tempering Valve (TV-2): Haws Model 9201

HH. Neutralization Trap (NT-1): Schier Products LP-2. 2 gallon capacity, lime chips.

II. Grease Trap (GT-1): Schier Products GB-75, See drawings for size and capacity.

JJ. Hot Water Circulation Pump (HWRP-1): Taco Model 0012, Horizontal, oil lubricated, in-line bronze pump, 125 psi working pressure rating. . See drawings for size and capacity. Provide timer set to normal school hours.

KK. Hot Water Circulation Pump (HWRP-2): Taco Model 0012, Horizontal, oil lubricated, in-line bronze pump, 125 psi working pressure rating. . See drawings for size and capacity. Provide timer set to normal school hours.

LL. Hot Water Circulation Pump (HWRP-3): Taco Model 0012, Horizontal, oil lubricated, in-line bronze pump, 125 psi working pressure rating. . See drawings for size and capacity. Provide timer set to normal school hours.

MM. Reduced Pressure Backflow Preventers (RPBP): 3" and smaller Watts Series 009, larger than 3" Watts Series 909, two in-line independent check valves, gate valve or ball valve shut-offs, FDA approved, replaceable seats and stainless steel internal parts, intermediate relief valve and test cocks.

NN. Trap Priming Valves: Precision Plumbing Products, Inc., model P-2.

OO. Traps:

1. Exposed Traps: 17 gauge chrome plated tubing adjustable P-trap with slip bushing.
2. Concealed or Below Grade: Coated cast iron P-trap, recessed screw joint or to match cast iron pipe.
3. Support Rims: Stainless steel rims, if sink not furnished with integral rim.

PP. Cleanout: J.R. Smith, Fig. 4020-U, Durco cast iron housing, vandal proof scoriated secured nickel bronze top for floor and bronze plug for floors; Fig. 4530-U Durco cast iron cleanout tee with counter sunk plug and stainless steel cover with vandal proof screw for walls, Fig. 4250-U cast iron housing, and vandal proof heavy duty secured scoriated cover with lift device, ABS plug cleanout for exterior planting and paved areas.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide plumbing fixture trim where applicable on fixture.
B. Plumbing Fixtures:
   1. Plumbing Fixtures Mounting Heights: All fixtures standard rough-in catalogued heights unless specified or shown otherwise on the architectural drawings.
   2. Cleanout:
      a. Where required for purposes intended.
      b. Cover set flush with finished surface.
      c. Urinal cleanouts to be below fixture on centerline.
   3. Floor Drains: Set top flush with finished floor unless noted otherwise on the architectural drawings.

C. Priming Valves:
   1. Floor Drain traps primed with priming valves and minimum 3/8” inside diameter copper tubing to floor drain or floor sink.
   2. One trap maximum primed from one priming valve.
   3. Where priming valves are installed in finished rooms, conceal in wall and provide access door.
   4. Install shutoff valve ahead of priming valve.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Control system architecture will be comprised of one the following:
   1. Distech Niagra framework.
      a. Furnish and install WEB supervisor 100 license version onto district virtual server.
      b. Furnish and install WEB programming tool.
      c. All programming tools required to access and modify the system software to reside in the JACE controllers.
      d. Establish communication to three Distech JACE controllers located in the sprinkler riser room at Gridlines G and 9 and make points available for access. Bring the system DDC points into the district server and integrate the system graphics to match Beaverton School District (BSD) standards. Existing JACE controllers communicate through Trane Comm4 driver licensed and installed on the existing JACE and LON protocol to the existing equipment.
      e. Establish communication to the Cafeteria building three HVAC systems (one JACE controller) and make points available for access through BACnet IP protocol – Bring the system DDC points into the district server and integrate the system graphics to match Beaverton School District (BSD) standards.
      f. Furnish all software, device installation, programming, technical assistance to the school district and product licenses required for complete operating control systems throughout the entire facility.
      g. All control identification points and HVAC systems graphics to conform to Beaverton School district naming standards – Verify with BSD project manager prior to initiation of programming and graphics development.
      h. Provide all temperature sensors, flow sensors, humidity sensors, IAQ sensors, control valves, control valve actuators, dampers, damper actuators, programming and other items necessary for a complete system and sequence of control for new equipment as identified in the contract drawings.
      i. All new equipment to have points as noted on Contract Drawing M2.41. All existing equipment to have existing points integrated into district server and system graphics.
   2. Johnson Controls Metasys Building Automation System.
      a. Utilize existing upgraded Metasys 7.0 ADS on district virtual server.
      b. Utilize the controller configuration tool (CCT) and the system configuration tool (SCT) programming tool resident on the district server.
      c. All programming tools associated with new controls required to access and modify the system software to reside on the ADS.

d. Establish communication to three JACE controllers located in the sprinkler riser room at Gridlines G and 9 and make points available for access through BACnet IP protocol. Bring the system DDC points into the district server and integrate the system graphics to match Beaverton School District (BSD) standards. Existing JACE controllers communicate through Trane Comm4 driver licensed and installed on the existing JACE and LON protocol to the existing equipment.
e. Establish communication to the Cafeteria building three HVAC systems (one JACE controller) and make points available for access through BACnet IP protocol – Bring the system DDC points into the district server and integrate the system graphics to match Beaverton School District (BSD) standards.
f. Furnish all software, device installation, programming, technical assistance to the school district and product licenses required for complete operating control systems throughout the entire facility.
g. All control identification points and HVAC systems graphics to conform to Beaverton School district naming standards – Verify with BSD project manager prior to initiation of programming and graphics development.
h. Provide all temperature sensors, flow sensors, humidity sensors, IAQ sensors, control valves, control valve actuators, dampers, damper actuators, programming and other items necessary for a complete system and sequence of control for new equipment as identified in the contract drawings.
i. All new equipment to have points as noted on Contract Drawing M2.41. All existing equipment to have existing points integrated into district server and system graphics.

B. Program all control diagrams and sequences of operation into the system graphics to allow visual review of diagrams / sequence when viewing system programming.
C. Existing Pneumatic Controls.
1. Remove all existing pneumatic controls and tubing.
2. Remove the existing pneumatic air compressor and deliver to the owner – Verify location with the district project manager.
3. No equipment controlled by pneumatic control systems should be present in the building at project completion.
D. Furnishing and installing all control hardware and software necessary for a complete DDC control system as specified.
E. Final installation will allow all school control components to be monitored / controlled at a single point by district personnel through a single user interface.
F. Coordinate the installation of automatic control valves, dry wells for fluid temperature sensors, dampers and actuators with the mechanical contractor to assure all work required for a complete system is included in the base bid.
G. The drawings and Specifications are complementary to one another—meaning that what is called for on one is to be considered called for in both. Where conflicts exist between the Specifications and/or drawings, it is the responsibility of the Controls Contractor to bring the conflict to the attention of the Owner.

H. The Controls Contractor shall be responsible for field verification of site conditions and for gathering all necessary field data for all items to be provided under this contract prior to submitting his or her bid.
I. Where work specified under other Sections of this Specification connects to equipment or systems that are listed and described in this Section, the Controls Contractor shall coordinate with other trades to provide proper connection(s) to such equipment.

1.2 SUBMITTALS

A. Transmit submittals through e-Builder.
B. In diagrams, show complete piping or ductwork system schematics with DDC and electrical control devices and wiring superimposed.
C. Completely identify all control devices with manufacturer's type, number, and functional description.
D. Uniquely identify all control wire and conduit on the drawings with a logical numbering system.
E. Show all electric and hydronic connections of the control system to equipment furnished by others, complete to terminal points specifically identified with manufacturer's terminal designation.
F. In booklet form, provide a bill of material and catalog data on all control device types, including control operation description, technical parameters and connection identifications. Describe the complete sequence of operation containing all information necessary for clarity and understanding of device function and system sequence of operation.
G. Furnish a trunk cable schematic showing the local area network drawings.
H. Furnish a list of connected data points, including connected control unit and input device.

1.3 OPERATING AND MAINTENANCE DATA:

A. Submit a copy of the Operation and Maintenance Manual to the e-Builder before project completion. Bind the instruction books with three-ring 8-1/2" x 11" side binders with plastic covers. Include the following documentation in the data:
   1. General description and cut sheets for all components.
   2. Detailed wiring and installation illustrations and complete calibration procedures for each field and panel device.
   3. Complete trouble-shooting procedures and guidelines.
   4. Complete operating instructions for all systems.
   5. Maintenance Instructions: Document all maintenance and repair/replacement procedures.
B. Include the following documentation in the DDC Software Manual:
   1. Sequence of Operations
   2. Program Listing of Software Source Code OR Flow Chart Diagrams of Programming Objects.
   3. Printed listing of controller and operator workstation database files.
   4. Software Point Name Abbreviation List. Include Name, Description, Controller Where Located, Point Type and Point ID.

5. I/O Point List. Include Point Name, Controller Location, Point Number, Control Device, Range and Span.
6. Printouts of the following; Reports, Group Listings and Alarm Messages.
7. Index of all DDC point names with documentation, manual page number references.

C. Provide three copies of all manufacturers manuals covering the installed system. This shall include, as a minimum:
1. System Engineering Manual
2. System Installation Manual
3. Programming Manual
4. Engineering and Troubleshooting Bulletins
5. Operator Workstation Software Manual
6. All other pertinent manuals published by the control system manufacturer.

D. All manuals shall be provided in hard copy format and on a single Compact Disk (CD). The electronic files on the CD must be submitted in a user editable format, scanned files are unacceptable. Copyrighted factory manuals may be in a PDF file.

E. Record Documents
1. Provide a complete set of control drawings with as-installed equipment and operating sequences on paper and in electronic format (AutoCAD, or Visio). "As-built" documentation shall include the following as a minimum:
   a. Documentation of all deviations from the shop drawing submittals. Including what equipment was changed and the reason for the change.
   b. All data specified in the Submittals section in its final "as-built" form for all Air Handling Units and HVAC systems.
   c. Record of work as–installed, including exact location of control panels, controllers, and wiring routes.
   d. Schematic outline of the overall control system
   e. Sequence of operation, point names, setpoints and limits for all Air Handling Units and HVAC systems.
   f. Copies of final test reports, final air balance reports, and any deficiency lists.
   g. Documentation of all deviations from O&M information provided with Submittals, including but not limited to, changes in programming and source code.

F. Warranty
1. Material: The Control System shall be free from defects in material and workmanship under normal use and service. If within thirty six (36) months from the date of substantial completion any of the equipment herein described is defective in operation, workmanship or materials, it will be replaced, repaired or adjusted at the option of the Controls Contractor free of charge.
2. Installation: The Control System shall be free from defects for a period of one year from acceptance. The Controls Contractor shall, free of charge, correct any defects in workmanship within one week of notification in writing by the Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS / INSTALLERS:

A. Acceptable Controls Contractors: Johnson Controls, Inc., Northwest Control Contractors, or Heinz Mechanical, Inc. Selection of Controls Contractors is subject to approval by BSD.
B. The Controls Contractor shall be regularly engaged in the engineering, programming, installation, and service of Control Systems by the selected manufacturer and shall have a minimum of five years' experience with the complete, turn-key installation of Controls by the same manufacturer of similar size and technical complexity.
C. If portions of the installation will be performed by a subcontractor, the Controls Contractor will submit to BSD, two sample installations performed by subcontractor which are similar to the current project.
D. The Controls Contractor shall have a local branch facility within a 75-mile radius of the job site. Emergency service shall be available on a 24-hour, 7-day-a-week basis.
E. Controls Contractors not currently approved by the District shall provide a list of five comparable projects that have Controls with the features as specified for this project. These projects must be on-line and functional.

2.2 CONTROL WIRING / COORDINATION WITH LINE VOLTAGE CONTROL

A. Provide control wiring to all control modules, sensors, pilot duty control relays and actuators required to provide the project sequences of operation.
B. Provide control interface to boilers, pumps and fans. This shall include pilot duty relays where interface to line voltage switching devices is required.
C. All control wiring exposed in occupied areas to be in conduit.
D. Provide all control system related conduit within mechanical room or at equipment locations unless specifically shown to be in other divisions work.
E. Electrical Contractor shall provide all required conduit, contactors, magnetic starters and motor control centers required for operation of mechanical systems except where specifically noted to be provided by equipment manufacturer.
F. All wiring not in conduit or control cabinets shall be rated for plenum installation.
G. Provide conduit where required between the zone temperature sensor locations and the zone equipment. Provide all wiring / conduit in the base bid necessary for a complete operating control system.

2.3 AUTOMATION SYSTEM / DDC CONTROL DEVICES

A. The District currently has two enterprise level platforms: The ADX server, Tridium Niagra AX.
B. All Niagara products will be open licensed and all programming tools used in the project will be licensed to BSD and provided as part of the project.
C. All Johnson programming tools used in the project will be provided to BSD as part of the project.

D. Supervisory Controllers shall have a web-based user interface available through current web browsers using standard communications protocols. The Supervisory Controller shall be housed at the local building level. Supervisory Controllers shall have communications buses for, and be capable of communicating on, one of the two approved protocols.

E. Approved new communications protocols for his project will be BACnet. Basic graphics shall reside in the Supervisory Controller.

F. Software application used to access server and supervisory controllers on building network shall be Windows and Macintosh based and approved by BSD.

G. Local (building level) controls that use IP standards shall communicate on a subnetwork behind a Router / Switch. When BACnet IP communications are used, the Project Design Team shall coordinate capacity and security needs with IT design. Otherwise, the Supervisory Controller will serve as the switch or gateway between the District network and the communications buses. All IP communication lines and equipment shall be tested to meet or exceed current industry standards.

H. Systems using more than one internet connection must have prior approval from BSD Representative.

I. Programming shall use BSD naming conventions to ensure continuity between systems. The existing file path on an Enterprise Server defines the naming convention and file structure for that server. This convention provides a unique name for every point on the District's network and ensures that summaries and reports are consistent. Programming and point naming shall follow conventions used on the applicable Enterprise Server and must be obtained from the BSD HVAC Department no later than the beginning of Design Development. These conventions must be used during controls design, programming, and in the specifications.

J. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, Controllers and operator devices.

K. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

L. Distributed Control
   1. System shall observe the concept of distributed control.
   2. All modules shall have "stand alone" capability and shall maintain operator setpoints without connection to primary controllers or central station equipment.
   3. Modules shall be located at each operating equipment location such that individual systems or zones shall remain functional without communication to other systems on the network.
   4. Equipment operating logic, schedules and current trends shall reside in control modules serving each system.
   5. Use of global modules required to maintain programming, schedules or current trend data are not acceptable.

M. Controllers / Control Modules
   1. Local Control Units for HVAC equipment shall be factory installed.
   2. Local Control Units shall be by approved manufacturer.
   3. Local Control Units shall use approved communication protocol. Preferred protocols are JCI Metasys BACnet, BACnet IP, BTL listed, BACnet MS/TP.
   4. Local Control Units shall operate as stand-alone controllers capable of performing specified control responsibilities independent of other controllers in the network.
   5. All Application-Specific Controllers must be capable of remote programming over the District Enterprise network and all programs required will be installed, licensed to BSD, and BSD personnel will be trained on their use.
   6. Each controller shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each controller shall be a microprocessor-based, multi-tasking, real-time digital control processor. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
   7. Controllers shall include required inputs and outputs to meet sequence of operation and points list. Digital outputs shall be dry contact relays and analog outputs shall be industry standard 0-10 vdc, 2-10 vdc or 4-20 milli-amp. Modules shall be fully programmable.
   8. Controllers shall have battery backup capable of maintaining all programs, setpoints, schedules and trend information for a minimum of 7 days.
   9. All schedules and current trends shall be maintained in the individual controllers. The controllers shall be capable of maintaining sufficient trend samples to report 24 hours of trend history in 5 minute increments for each input or output.

N. Temperature Sensors
   1. Wall mounted zone temperature sensors shall be 10 k ohm thermistor.
   2. Zone sensors in primary occupied areas other than restrooms, hallways or storage rooms shall have a slider type set point adjustment to allow the occupants to raise or lower the set point within operator defined parameters.
   3. Additionally sensors in these primary areas shall have a push button to return the system to normal occupancy setpoints for an operator defined period. Exception will be common areas. Gymnasium sensors shall also include a key access override feature.
   4. General building wall sensors will be:
      a. Temperature only with slider type temperature adjustment and occupancy override button.
      b. Temperature and CO2 with slider type temperature adjustment, occupancy override button and both temperature and CO2 control through a single control point.
   5. All other temperature sensors shall be industry standard thermistor or 4-20 milli-amp. Immersion sensors shall be mounted in a blind well for future serviceability.

O. Valve and Damper Actuators
   1. Actuators shall be manufactured by Belimo.
   2. Torque shall be rated for required load.
   3. Modulated actuator input shall be industry standard 0-10 vdc, 2-10 vdc, 4-20 milli-amp, floating motor (tri-state), or pulse width modulation.
   4. Two or three position operation is not acceptable for economizers, VAV dampers, multi-zone dampers, valves or any other application specifying modulated operation.

P. Thermowells
   1. When thermowells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting.
   2. Thermowells shall be pressure rated and constructed in accordance with the system working pressure.
   3. Thermowells and sensors shall be mounted in a threadolet or 1/2" NFT saddle and allow easy access to the sensor for repair or replacement.
   4. Thermowells shall be constructed of 316 stainless steel.

Q. Outside Air Sensors
   1. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
   2. Sensor's exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
   3. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

R. Duct Mount Sensors
   1. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
   2. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
   3. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

S. Averaging Sensors
   1. For ductwork greater in any dimension that 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
   2. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
   3. Capillary supports at the sides of the duct shall be provided to support the sensing string.
   4. Acceptable Manufacturers: Johnson Controls, Mamac, Penn, Setra.

T. Differential Pressure Transmitters
   1. General Air and Water Pressure Transmitter Requirements:
      a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.

b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device. And shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow permanent, easy-to-use balancing connections for the Contractor and the Owner.
d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.

2. Low Differential Water Pressure Applications (0" - 20" w.c.)
a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.
b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
- .01-20" w.c. input differential pressure range.
- 4-20 mA output.
- Maintain accuracy up to 20 to 1 ratio turn-down.
- Reference Accuracy: +0.2% of full span.

c. Acceptable Manufacturers: Setra and Mamac.

3. Medium to High Differential Water Pressure Applications (Over 21" w.c.)
a. The differential pressure transmitter shall meet the low pressure transmitter specifications with the following exceptions:
- Differential pressure range 10" w.c. to 300 PSI.
- Reference Accuracy: ±1% of full span (includes non-linearity, hysteresis, and repeatability).

b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
c. Acceptable Manufacturers: Setra and Mamac.

U. Building Differential Air Pressure Applications (-1" to +1" w.c.)
1. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
2. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
a. -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
b. 4-20 mA output.
c. Maintain accuracy up to 20 to 1 ratio turndown.
d. Reference Accuracy: +0.2% of full span.
3. Acceptable Manufacturers: Johnson Controls and Setra.

V. Low Differential Air Pressure Applications (0” to 5” w.c.)
1. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
2. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
- (0.00 - 1.00” to 5.00”) w.c. input differential pressure ranges. (Select range appropriate for system application.)
- 4-20 mA output.
- Maintain accuracy up to 20 to 1 ratio turn-down.
- Reference Accuracy: +0.2% of full span.

3. Acceptable Manufacturers: Johnson Controls and Setra.

W. Medium Differential Air Pressure Applications (5” to 21” w.c.)
1. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements:
- Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability.
- Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 PSIG.
- Thermal Effects: <+.033 F.S. /Deg. F. over 40°F. to 100°F. (calibrated at 70°F.).

2. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
3. Acceptable manufacturers: Johnson Controls and Setra.

X. Power Monitoring Devices
1. Current Measurement (Amps)
2. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Controls.
3. Current Transformer – A split core current transformer shall be provided to monitor motor amps.
- Operating frequency – 50 - 400 Hz.
- Insulation – 0.6 Kv class 10Kv BIL.
- UL recognized.
- Five-amp secondary.
- Select current ration as appropriate for application.
- Acceptable manufacturers: Veris Industries

Y. Current Transducer – A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
1. 6X input over amp rating for AC inrushes of up to 120 amps.

2. Manufactured to UL 1244.
3. Accuracy: +.5%, Ripple +1%.
4. Minimum load resistance 30kOhm.
5. Input 0-20 Amps.
6. Output 4-20 mA.
7. Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).
8. Acceptable manufacturers: Veris Industries

Z. Smoke Detectors: Ionization type air duct detectors.

AA. CO_2 Sensors: self-calibrating sensors are acceptable but sensor must easily allow field calibration with test gas. Sensors must retain accuracy for between 3 - 5 years without requiring calibration. Sensors that require annual calibration are not acceptable. Provide CO_2 sensor calibration tool with system. Sensors must be calibrated at system start-up. Calibration tool is to be turned over to Owner along with instructions for use at closeout.
1. CO_2 sensor output shall be 4 – 20 mA or 2 – 10 VDC proportional over the specified range. Minimum sensor accuracy and range:
2. CO_2 0 – 2000 ppm, ± 3% full scale
3. The transmitter shall be capable of operating from an unregulated 18 – 30 VDC power supply.
4. Acceptable Manufacturers: Veris Industries, Johnson Controls.

BB. Status and Safety Switches
1. General Requirements
   a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the CONTROLS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

CC. Current Sensing Switches
1. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
2. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
3. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
4. Acceptable manufacturers: Veris Industries.

2.4 AUTOMATION SYSTEM SOFTWARE

A. The software capability noted below is a minimum requirement.
B. Scheduling.
   1. The DDC system shall have the ability to schedule each individual zone, each building or floor or the entire network of buildings for any user with a single entry.
   2. Additionally the operator shall have the capability of assembling groups of zones, buildings or floors for single entry programming, e.g. several offices may be grouped for scheduling of Saturday operations.
   3. Available schedule types shall include normal operation, unoccupied operation, setback override and holidays.
   4. For maximum flexibility, schedules shall reside in the local control modules. Dated schedules shall be self-managing and automatically deleted after execution.
C. Demand Control – Provide one of the two following capabilities (1or 2).
   1. The system shall have the ability to receive an analog or digital input of electrical usage/demand through any open input on a general purpose module. This capability shall be provided without additional hardware except the single input point and digital or analog devices required to read electrical demand levels
   2. The system shall include required demand control hardware and software for monitoring electrical usage and controlling demand. Demand control shall be achieved by adjusting zone temperature setpoints as electrical demand thresholds are reached. Zone setpoint offset shall be individually adjustable to allow prioritization of zone comfort conditions. Multiple demand level threshold parameters shall be available to allow more aggressive control as building demand rises. Additionally the demand control strategy shall automatically adjust the demand level thresholds based on ambient temperature to meet peak space conditioning requirements and minimize peak demand during mild temperature months.
   3. The system shall be capable of rotating greater or lower demand levels every 10 minutes to alternate zones throughout the facility to minimize long term set point offset.
D. Interactive Operations - The system shall have the ability to send run requests, heating requests and cooling requests from one module to another for the purpose of optimizing run operations of central plant equipment. Additionally the system shall be capable of limiting operation of various equipment if another mechanical point elsewhere in the system allows that operation. E.g. a boiler loop circulating pump shall run only when requested by a zone requiring heating operation and will shut down during hours that zone demand is satisfied.
E. Energy Reports. System shall include an easily configured energy reporting tool that provides the capabilities described in this section.
   1. The energy reporting tool shall be accessible through the same user interface (Web browser or operator workstation software) as is used to manage the BAS.

2. The energy reporting tool shall be preconfigured by the Contractor to gather and store energy demand and consumption data from each energy source that provides metered data to the BAS. Meter data shall be stored at 5 minute. This data shall be maintained in an industry standard SQL database for a period of not less than five years.
3. The energy reporting tool shall allow the operator to select an energy source and a time period of interest (day, week, month, year, or date range) and shall provide options to view the data in a table, line graph, bar graph, or pie chart. The tool shall also allow the operator to select two or more data sources and display a comparison of the energy used over this period in any of the listed graph formats, or to total the energy used by the selected sources and display that data in the supported formats.
4. The energy reporting tool shall allow the operator to select an energy source and two time periods of interest (day, week, month, year, or date range) and display a graph that compares the energy use over the two time periods in any of the graph formats listed in the previous paragraph. The tool shall also allow the operator to select multiple energy sources and display a graph that compares the total energy used by these sources over the two time periods.
5. The energy reporting tool shall allow the operator to easily generate the previously described graphs "on the fly," and shall provide an option to store the report format so the operator can select that format to regenerate the graph at a future date. The tool shall also allow the user to schedule these reports to run on a recurring basis using relative time periods, such as automatically generating a consumption report on the first Monday of each month showing consumption over the previous month. Automatically generated reports shall be archived on the server in a common industry format such as Adobe PDF or Microsoft Excel with copies e-mailed to a user editable list of recipients.
6. The energy reporting tool shall be capable of collecting and displaying data from the following types of meters:
   a. Electricity
   b. Gas
   c. Potable Water
   d. Heating and cooling degree days. (May be calculated from sensor data rather than metered.)
7. The user shall have the option of using kW (kWh) or Btu/hr (Btu) as the units for demand and consumption reports. Multiples of these units (MWH, kBtu, etc.) shall be used as appropriate. All selected sources shall be automatically converted to the selected units. The user shall similarly have the option of entering facility area and occupancy hours and creating reports that are normalized on an area basis, an annual use basis, or an occupied hour basis.
8. The user shall have the option of entering benchmark data for an individual facility or a group of facilities.
9. The user shall have the option of displaying any or all of the following data on any chart, line, or bar graph generated by the energy reporting tool:
10. Low / High / Average value of the metered value being displayed.
11. Heating and/or Cooling Degree Days for the time period(s) being displayed.

12. The Environmental Index for the facilities and time periods being displayed.
    a. Environmental Index. System shall monitor all occupied zones and compile an index that provides a numerical indication of the environmental comfort within the zone. As a minimum, this indication shall be based upon the deviation of the zone temperature from the heating or cooling setpoint. If humidity is being measured within the zone then the environmental index shall be adjusted to reflect a lower comfort level for high or low humidity levels. Similarly, if carbon dioxide levels are being measured as an indication of ventilation effectiveness then the environmental index shall be adjusted to indicate degraded comfort at high carbon dioxide levels.
    b. Other adjustments may be made to the environmental index based upon additional measurements. The system shall maintain a trend of the environmental index for each zone in the trend log. The system shall also compute an average comfort index for every building included in this contract and maintain trend logs of these building environmental indices. Similarly, the system shall compute the percentage of occupied time that comfortable conditions were maintained within the zones. Through the UI the user shall be able to add a weighting factor to adjust the contribution of each zone to the average index based upon the floor area of the zone, importance of the zone, or other static criteria.

F. Alarms, Trends and Reports
    1. System and Temperature Alarms - The system shall have the capability of monitoring conditions throughout the system and sending alarms or messages to an e-mail address, local PC or printer or to remote PC's, printers or to dial-up pagers. Alarms and messages shall be able to be prioritized for various levels of reporting and action. The operator shall have the ability to customize alarm text and messages.
    2. Trends - The system shall be capable of trending any input or output, or any logical point within the graphic program. There shall be no limitation to the number of points that can be trended at any particular time. Modules shall store in live memory 288 trend samples points for each trended item. The interval between trend samples shall be adjustable from 1 second to 24 hours. Trends from one or more modules shall be able to be simultaneously displayed on a single trend graph. Operator shall be able to "window" any segment of a trend to enlarge the view by dragging a mouse to form the "window". The system shall also have the ability of automatically downloading trend information from any module to the server or other computer connected to the network for historical trend storage. This trend information shall be able to be displayed on the trend graph along with live current trends in seamless fashion. Trend data collection requiring the use of a locally connected PC for data storage is unacceptable.

3. Reports - The system shall be capable of generating reports of equipment run times, all trended points, temperature conditions, electric demand and usage and alarms or messages. The system shall also have the ability of automatically downloading report information from any module to the server or other computer connected to the network. The operator shall have the ability to create custom report and logging formats.

PART 3 - EXECUTION

3.1 INSTALLATION PRACTICES

A. HVAC Control System Wiring
   1. All conduit, wiring, accessories and wiring connections required for the installation of the Controls, as herein specified, shall be provided by the Controls Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All penetrations shall be sealed to prevent smoke and fire infiltration. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
   2. All system input wiring shall be twisted shielded pair, minimum 18-gauge wire. All system analog output wiring shall be twisted shielded pair/3-wire as required, minimum 18 gauge wire. Pre-configured cables between Terminal Unit Controllers and Thermostats are acceptable, minimum 24 gauge.
   3. All internal panel device wiring for binary outputs and pilot relay shall be minimum 16-gauge wire.
   4. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
   5. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements. Exposed wiring shall only be allowed in concealed accessible locations.
   6. Low voltage control wiring and 24VAC can be run in the same conduit. Power wiring 120VAC and greater must be in a separate conduit.
   7. All wiring in mechanical rooms shall be in conduit. Minimum control wiring conduit size 3/4-inch.

B. Identification Standards
   1. Controller Identification. All controllers shall be identified by a plastic engraved nameplate securely fastened to the outside of the controller enclosure.
   2. Panel Identification. All local control panels shall be identified by a plastic engraved nameplate securely fastened to the outside of the controller enclosure.
   3. Field Devices. All field devices shall be identified by a typed (not handwritten), securely attached tag label.
   4. Panel Devices. All panel devices shall be identified by a typed label that is securely fastened to the back-plane of the local control panel.

5. Raceway Identification. All the covers to junction and pull boxes of the control system raceways shall be painted blue, or have identification labels stating "Control System Wiring" affixed to the covers. Labels shall be typed, not hand written.
6. Wire Identification. All low and line voltage control wiring shall be identified by a number, as referenced to the associated control diagram, at each end of the conductor or cable. Identification number shall be typed and permanently secured to the conductor or cable. Wiring to all control devices shall be labeled at each end of the conductor with the point name and description.

C. Digital Controller Systems
1. Each system will be provided with its own dedicated direct digital controller or application specific controller. Mechanical systems such as AHUs, VAVs or Packaged system shall not be controlled from more than 1 application specific controller.
2. Systems that use second tier controllers as point expansion for system controllers shall only be allowed when the I/O points are directly controlled by the CPU of the local second tier controller.

D. Input Devices
1. All Input devices shall be installed per the manufacturer's recommendation. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, duct smoke detectors, airflow stations, etc.
   a. Low Differential Air Pressure Applications (Under 5" w.c.) Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing contractor and Owner permanent easy-to-use connection. Provide a minimum of a NEMA 1 housing for the transmitter. Locate transmitters in accessible local control panels wherever possible. Except on VAV box applications.
   b. Medium Differential Air Pressure Applications (5" to 21" w.c.) Mount stand-alone pressure transmitters in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with hi and low connections piped and valved. Air bleed units, bypass valves and compression fittings shall be provided.
   c. Medium to High Differential Water Pressure Applications (5" to Over 21" w.c.): Mount stand-alone pressure transmitters in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with hi and low connections piped and valved. Air bleed units, bypass valves and compression fittings shall be provided.
   d. Building Differential Air Pressure Applications (-1" to +1" w.c.): Mount pressure transmitter in the local control panel. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind. The interior tip shall be inconspicuous and located within a central corridor shown on the drawings.

e. Air Flow Measuring Stations: Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct. Station flanges shall be two inch to three inch to facilitate matching connecting ductwork. Stations shall be installed in strict accordance with the manufacturer's published requirements, and with ASME Guidelines affecting non-standard approach conditions.

f. Water Flow Monitoring Stations: Water Flow Monitoring Stations shall be installed in strict accordance with the manufacturer's published requirements, and with ASME Guidelines affecting non-standard approach conditions.

g. Outside Air Humidity Sensors: Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with seal-tite fittings and stainless steel bushings.

h. Outside Air Sensors: Outside air sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air temperatures accurately. Sensors exposed to solar radiation must be installed with solar shields. Sensor's that are exposed to wind velocity pressures shall be shielded by a perforated plate surrounding the sensor element.

i. Duct Temperature Sensors: Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned to be easily accessible for repair or replacement. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. For ductwork greater in any dimension that 48 inches and/or air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor with multiple sensing points. The sensor shall be mounted to suitable supports using factory approved element holders. For large plenum applications such as mixed air temperature measurements, utilize a string of sensors mounted across the plenum to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12 feet long segment.

j. Space Temperature Sensors: Shall be mounted at 60" above the finished floor. Temperature sensors installed in public areas shall be provided with lockable covers to prevent tampering.

k. Low Temperature Limit Switches: Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

l. Differential Pressure Status Switches: Provide complete installation kit including; static pressure tops, tubing, fittings and air filters. Provide appropriate scale range and differential adjustment for intended service.

E. Output Devices
   1. All output devices shall be installed per the manufacturer's recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, etc.
   2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
   3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
   4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.

3.2 Electronic Signal Isolation Transducers: Whenever an analog output signal from the Controls is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

3.3 INSTALLATION

A. Salvage all control devices / controllers not reused and deliver to the owner.

B. Single source responsibility of supplier shall be the complete installation and proper operation of the building automation system and control system and shall include debugging and proper calibration of each component in the entire system.

C. Provide all controllers to accomplish the control sequences specified herein.

D. Provide / coordinate the installation of; sensors, pipe wells, relays and any other devices and materials required to accomplish the functions described herein.

E. Identification - Provide nameplates identifying all switches, lights and starters, and each control device where the control function is not readily apparent.

3.4 SEQUENCES OF OPERATION

A. Sequence Intent.
   1. The sequences noted below outline the intent to control the buildings in an efficient manner providing comfort to the occupants. Standardized programs from the contractor / manufacturer to accomplish the intent of the sequences are preferable to heavily customized programming features.
   2. Submit standardized control routines for review with energy and comfort features noted as well as any major deviations from the sequences noted below.

B. Building Automation System Point Schedule: Provide monitoring and control functions as listed herein for each piece of equipment listed below. Provide a point list that includes each hard wired, calculated and/or resettable point.

C. Distributed Control – The control system shall observe the concept of distributed control. Modules shall be located at each operating equipment location such that individual systems or zones shall remain functional without communication to other systems on the network.

D. Energy Compliance:
   1. Provide 365 day, 24 hour occupancy scheduling.
   2. Provide sensors and/or software routines to operate the rooftop and terminal units to maintain the minimum night low limit temperature for that system. Operate the rooftop units, terminal units, boiler, pumps, coil valves, etc. as required. Outside air damper to remain closed on night low limit heating.
   3. When controlling both heating and cooling (mechanical), provide a 5-degree deadband in which the heating energy provided to the zone is reduced to a minimum.
   4. Provide optimum start controls to enable a morning warm-up cycle capable of varying the unit start time to meet occupied setpoint at scheduled time of occupancy.
   5. Close outside air dampers as appropriate to the equipment when the units are off and during the warm-up period.

E. Packaged Rooftop VAV System Control: The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up / Pre-Cool, Occupied / Unoccupied and Heat / Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints. The BAS shall also send the controller a duct static pressure setpoint, discharge air temperature setpoint, and ventilation airflow setpoint, each calculated by optimization routines in the BAS. The Building Automation System (BAS) shall include a user-adjustable time-of-day schedule to define when the various areas of the building are occupied versus unoccupied. Then, based on current zone conditions, the BAS determines the current system operating mode.
   1. Occupied Heat / Cool
      a. During occupied periods, the supply fan shall run continuously and the outside air damper shall open to current airflow setpoint. The unit controller shall control the supply fan VFD to maintain the current duct static pressure setpoint (adjustable).
      b. The DX cooling shall stage / modulate to maintain the current discharge air temperature setpoint. If economizing is enabled the outside air damper shall modulate to maintain the current discharge air temperature setpoint.
      c. Position the outdoor-air damper to bring in required amount of ventilation and modulate the exhaust fan to maintain building pressure at the desired setpoint,
   2. Economizer Cycle.
      a. Actuators shall operate outside air and return dampers in accordance with system operating status, supply air, zone air temperatures, and outside air temperatures.
      b. Outside Air Damper is closed when system is not operating.
      c. Occupied: Modulate between minimum outside air position and 100% open to meet the cooling requirements of the zone being served
      d. Closed during unoccupied hours and warm up mode operation.

3. Return Air damper.
   a. Damper shall track operation of outside air damper.
   b. Full open during unoccupied hour operation.
4. Demand controlled ventilation shall be controlled by a CO^2 sensor input to a PID control loop. CO^2 set point shall be 800 PPM.
   a. On rise of CO^2 above set point OA and RA dampers shall modulate inversely up to the maximum position noted in the equipment schedule.
   b. On fall of CO^2 below 800 PPM OA and RA dampers will return to minimum / minimum ventilation position if minimum position is required.
   c. If CO^2 reaches 1000ppm and alarm will be generated.
   d. If CO^2 reaches 1500 PPM a high CO^2 alarm shall be generated.
   e. If CO^2 drops below 200 PPM a CO^2 sensor failure alarms shall be generated.
5. Unoccupied Heat/Cool
   a. During the Unoccupied Mode, each fan powered terminal unit enables a terminal fan and full hot water heating valve modulation (heating set point) to maintain the zone temperature at the unoccupied set point.
   b. Each terminal unit is enabled separately to maintain the zone unoccupied temperature.
   c. When unit is off, outside air, exhaust air and terminal unit dampers are closed.
6. Morning Warm-up
   a. The BAS enables the RTU gas heating section and modulates the supply fan and gas furnace to deliver the required airflow to the zones.
   b. The RTU supply fan shall run continuously until the zone occupancy temperature setpoints (or adjustable offset temperatures) is reached. The unit will then operate in occupied mode.
   c. During the Morning Warm-up, each VAV terminal unit varies primary airflow to raise the zone temperature to the occupied heating set point and then closes.
7. Optimal Start
   a. The BAS shall initiate Optimal Start mode such that the RTU is started and VAV boxes are enabled to allow the zone temperature to reach the occupied heating or cooling set point prior to scheduled occupancy. The system shall wait as long as possible before starting, so that the temperature in each zone reaches the occupied set point just in time for scheduled occupancy.
   b. The BAS shall determine the actual time to initiate Optimal Start based on the current zone temperature, occupied cooling and heating setpoints, and historical optimal start performance data.
   c. The system shall be prevented from starting prior to 120 minutes (adjustable) before scheduled occupancy.

8. Optimal Stop
   a. The BAS shall initiate Optimal Stop mode such that cooling or heating is disabled so that the zone temperature does not drift beyond the occupied standby set point by the end of the scheduled occupancy period. The RTU supply fan shall continue operating, and ventilation control shall continue, through the end of the scheduled occupancy period.
   b. The BAS shall determine the actual time to initiate Optimal Stop based on the current zone temperature, occupied cooling and heating setpoints, and historical optimal stop performance data.
   c. The system shall be prevented from entering Optimal Stop mode prior to 120 minutes (adjustable) before the end of the scheduled occupancy period.
9. Unoccupied Economizing (Night Purge)
   a. Between 4:00 AM (adjustable) and 6:00 AM (adjustable), the BAS shall initiate Unoccupied Economizing mode if the current zone temperature is at least 1°F warmer than the occupied cooling set point and the outdoor dry-bulb temperature is more than 15°F (adjustable) cooler than the current zone temperature.
   b. When initiated, the RTU is started (OA damper fully open, compressors off) and VAV boxes are enabled to allow the zone temperature to cool to the occupied cooling set point.
10. Optimized Control of Supply Duct Static Pressure (Fan-Pressure Optimization)
   a. At a frequency of once every 10 minutes, the BAS shall monitor the damper position of all VAV terminal units. The BAS shall calculate a new supply fan duct static pressure set point based on the position of the furthest-open VAV damper, and send this newly-calculated set point to the RTU controller.
   b. When any VAV damper is more than 75% (adjustable) open, the supply fan duct static pressure set point shall be reset upward by 5% until no damper is more than 75% (adjustable) open or the static pressure set point has reset to the maximum setting.
   c. When all VAV dampers are less than 65% (adjustable) open, the supply fan duct static pressure set point shall be reset downward by 5% open until at least one damper is more than 65% (adjustable) open or the static pressure set point has reset to the minimum setting.
   d. The control bands, set point increment values, set point decrement values, and adjustment frequencies shall be adjusted to ensure stable system control and acceptable occupant comfort, while achieving overall system energy savings.
   e. The BAS must have the capability to allow the operator to indicate “problem” zones that should be ignored when determining the optimized set point.
   f. The BAS shall display both the current and design duct static pressure setpoints on the user interface, as well as the name of the current “critical” VAV terminal (the one with the furthest-open VAV damper).

11. Optimized Control of Supply Air Temperature (SAT Reset)
    a. At a frequency of once every 10 minutes, the BAS shall monitor the outdoor dry-bulb temperature, as well as the zone temperature and damper position of all VAV terminal units. The BAS shall calculate a new SAT setpoint based on current outdoor air (OA) temperature, and send this newly-calculated SAT setpoint to the RTU controller.
    b. When the OA temperature is warmer than 65°F (adjustable), the SAT setpoint shall be 55°F (adjustable). When the OA temperature is colder than 55°F (adjustable), the SAT setpoint shall be 60°F (adjustable). When the OA temperature is between 55°F (adjustable) and 65°F (adjustable), the SAT setpoint shall be reset proportionally between 55°F (adjustable) and 60°F (adjustable).
    c. If at least two (adjustable) zones have both 1) a VAV damper that is more than 75% open, and 2) a current zone temperature that is higher than the current cooling setpoint, then the SAT setpoint shall return to 55°F (adjustable).
    d. Reset Based On Demand: If the outdoor dew point is higher than 60°F (adjustable), this SAT Reset sequence shall be suspended and the SAT setpoint shall be reset to 55°F (adjustable) until the outdoor dew point drops below 57°F (adjustable).
12. The control bands, setpoint range, and adjustment frequencies shall be adjusted to ensure stable system control and acceptable occupant comfort, while achieving overall system energy savings.
13. The BAS shall display both the current and design SAT setpoints on the user interface.
14. Optimized Control of Ventilation (Ventilation Optimization).
    a. The actual outdoor airflow shall be measured at the outdoor air intake of the RTU, and controlled to an airflow setpoint determined according to ASHRAE Standard 62.1.
    b. When the BAS time-of-day schedule indicates that a zone is unoccupied, the required outdoor airflow for that zone shall be zero.
    c. When the schedule indicates that a zone is occupied, the required outdoor airflow for that zone shall equal the design outdoor airflow (based on design occupancy), unless the zone is equipped with occupancy sensor and/or a carbon dioxide (CO_2) sensor, or uses a time-of-day ventilation schedule, to reduce the required outdoor airflow during periods of partial occupancy.
    d. For those zones equipped with an occupancy sensor, the required outdoor airflow for the zone shall be continuously determined based on whether people are present or not. When the occupancy sensor indicates that people are present in the zone, the required outdoor airflow shall equal the design outdoor airflow. When the occupancy sensor indicates that no people are present in the zone, the required outdoor airflow shall equal the “occupied standby” outdoor airflow.
    e. For those zones equipped with a CO2 sensor, the required outdoor airflow for the zone shall be continuously calculated using the measured CO2 concentration as an indicator of the current per-person ventilation rate.

15. The required outdoor-air fraction (current required outdoor airflow divided by the current primary airflow) shall be continuously calculated for each zone (VAV terminal unit).
    a. At a frequency of once every 10 minutes, the BAS shall gather this data from all VAV terminal units, calculate the minimum required outdoor airflow for the system according to ASHRAE 62.1, and send this newly-calculated outdoor airflow setpoint to the RTU controller.
    b. The control bands, setpoints, and adjustment frequencies shall be adjusted to ensure stable system control and acceptable occupant comfort, while achieving overall system energy savings.
    c. The BAS must have the capability to allow the operator to indicate "problem" zones that should be ignored when determining the optimized outdoor airflow setpoint.
    d. The BAS shall display both the current and design outdoor airflow setpoints on the user interface, as well as the name of the current "critical" VAV terminal (the one with the highest outdoor-air fraction).
16. Building Pressure Control: A differential pressure transducer shall actively monitor the difference in pressure between the building (indoors) and outdoors. If the building pressure increases above the differential pressure setpoint, the unit controller shall turn on the exhaust fan and modulate the exhaust fan VFD to control building pressure to the differential pressure setpoint. If the building pressure decreases below the differential pressure setpoint, the controller shall deactivate the exhaust fan VFD.
17. Exhaust Fan Status: A differential pressure switch shall monitor the differential pressure across the fan. If the switch is detected to be open for 40 consecutive seconds after a request for exhaust fan operation a fan failure alarm shall be annunciated at the BAS and the exhaust fan shall stop. A manual reset shall be required.
18. Filter Status: A differential pressure switch shall monitor the differential pressure across the filter when the fan is running. If the switch closes for 2 minutes after a request for fan operation a dirty filter alarm shall be annunciated at the BAS.

F. VAV Terminal Unit Control
1. The BAS shall send the controller Occupied and Unoccupied commands. The BAS may also send a Heat / Cool mode, priority shutdown commands, space temperature and / or space temperature setpoint. If communication is lost with the BAS, the VAV controller shall operate using its local setpoints.
2. Variable Volume Terminal Unit Control: Modulate air damper and the hot water heating valve in sequence to maintain room setpoint and minimum and maximum scheduled air volumes. Heating coils are to sequence with variable air volume damper to begin supplying heat only after terminal units reach minimum scheduled air flows during occupied periods. Main unit heating coils are to provide the heat needed during night low limit and warmup periods.

3. Parallel Fan Powered Terminal Unit Control: Modulate air damper, operate fan and the hot water heating valves in sequence to maintain room setpoint and minimum and maximum primary scheduled air volumes. Fans and heating coils are to sequence with variable air volume damper to begin supplying recirculated air and heat only after terminal units reach minimum scheduled primary airflows during occupied periods. The terminal unit fans and heating coils are to provide the heat needed during night low limit and warmup
4. Series Fan Powered Terminal Unit Control: Operate fan, modulate air damper and the hot water heating valve in sequence to maintain room setpoint and minimum and maximum primary scheduled air volumes. Fans are to operate continuously during occupancy and heating coils are to sequence with variable air volume damper to begin supplying heat only after terminal units reach minimum scheduled primary airflows during occupied periods. The terminal unit fans and heating coils (when available) are to provide the heat needed during night low limit and warmup periods.
5. Occupancy Modes: The occupancy mode shall be communicated or hardwired to the VAV via a digital input. Valid Occupancy modes for the VAV shall be:
   a. Occupied: Normal operating mode for occupied spaces or daytime operation. When the unit is in the occupied mode the VAV shall maintain the space temperature at the active occupied heating or cooling setpoint. Applicable ventilation and airflow setpoints shall be enforced. The occupied mode shall be the default mode of the VAV.
   b. Unoccupied: Normal operating mode for unoccupied spaces or nighttime operation. When the unit is in unoccupied mode the VAV controller shall maintain the space temperature at the stored unoccupied heating setpoint regardless of the presence of a hardwired or communicated setpoint. When the space temperature exceeds the active unoccupied setpoint the VAV shall modulate fully closed.
   c. Occupied Bypass: Mode used to temporarily place the unit into the occupied operation. Tenants shall be able to override the unoccupied mode from the space sensor. The override shall last for a maximum of 4 hours (adjustable.). The tenants shall be able to cancel the override from the space sensor at any time. During the override the unit shall operate in occupied mode.
6. Heat / Cool Mode: The Heat/Cool mode shall be set by a communicated value or automatically by the VAV. In standalone or auto mode the VAV shall compare the primary air temperature with the configured auto changeover setpoint to determine if the air is "hot" or "cold". Heating mode shall command the VAV to heat only morning warm-up); it implies the primary air temperature is hot. Cooling mode shall command the VAV to cool only; it implies the primary air temperature is cold.
7. Heat / Cool Setpoint: The space temperature setpoint shall be determined either by a local setpoint, the VAV default setpoint or a communicated value. The VAV shall use the locally stored default setpoints when neither a local setpoint nor communicated setpoint is present. If both a local setpoint and communicated setpoint exist, the VAV shall use the communicated value.

8. Cooling Mode: When the unit is in cooling mode, the VAV controller shall maintain the space temperature at the active cooling setpoint by modulating the airflow between the active cooling minimum airflow setpoint to the maximum cooling airflow setpoint.
9. Based on the VAV controller occupancy mode, the active cooling setpoint shall be one of the following (all values adjustable):

Setpoint	**Default Value**
Occupied Cooling Setpoint	72.0 deg. F
Unoccupied Cooling Setpoint	85.0 deg. F
Occupied Standby Cooling Setpoint	78.0 deg. F
Occupied Min Cooling Airflow Setpoint	See VAV Schedule
Occupied Max Cooling Airflow Setpoint	See VAV Schedule

10. Reheat Control: Reheat will only be allowed when the primary air temperature is 5.0 deg. F below the configured reheat enable setpoint of 70.0 deg. F (adjustable.). The reheat shall be enabled when the space temperature drops below the active heating setpoint and the minimum airflow requirements are met. During reheat the VAV shall operate as follows:
    a. If the space temperature is at the heating setpoint, the electric heater shall modulate as required to maintain space temperature at the active heating setpoint while the VAV operates at its minimum heating airflow setpoint.
    b. If the discharge air temperature reaches the design heating discharge air temperature setpoint (adjustable.), the VAV shall modulate airflow between the minimum heating airflow setpoint and the maximum heating airflow setpoint as required to maintain space temperature at the active heating setpoint, while the electric heater modulates to maintain discharge air temperature at the design heating discharge air temperature setpoint.
    c. If the airflow reaches the maximum heating airflow setpoint, the VAV shall modulate the electric heater as required to maintain space temperature at the active heating setpoint, while the VAV operates at its maximum heating airflow setpoint.
11. Space Sensor Failure: If there is a fault with the operation of the zone sensor an alarm shall be annunciated at the BAS. Space sensor failure shall cause the VAV to drive the damper to minimum air flow if the VAV is in the occupied mode, or drive it closed if the VAV is in the unoccupied mode.

G. Process Cooling Unit.
1. Standard operation: The integral process cooling control system will maintain the data room temperature based on the integral control components (setpoint by owner).
2. The BAS will monitor the room temperature based on a two wall sensor (opposite room walls). If the space temperature rises to a predetermined temperature setpoint (by owner-adjustable) – An alarm is sent to the BAS.
3. Provide communication via BACnet from the process cooling unit controller to the central BAS allowing monitoring and alarming of selected points from the process cooling unit system (points as determined by the owner). Coordinate with the process cooling unit supplier.

H. Heating Control – Heating Water Discharge Air Temp Control.
   1. On fall of temperature below the zone heating set point the HW valve shall modulate to maintain discharge air temperature sufficient to heat the zone.
   2. Heating will be locked out when outside air temperature is above 65°F.
   3. Discharge air temperature will be maintained through the use of a discharge air reset based on zone deviation from set point.
   4. There will be an initial set point, a minimum set point, and a maximum set point.
      a. Upon receiving fan status, the discharge air set point will initially be equal to the zone temperature.
      b. The discharge air set point will reset up or down as needed to maintain zone temperature set point.
   5. The ramp will calculate as follows.
      a. If the zone temperature is 0.25° below the heating set point, the DA reset will raise 2°every 5 minutes until the maximum DA setpoints are reached.
      b. If the zone temperature is at or above the heating set point, the DA reset will lower 2°every 5 minutes until the minimum DA setpoints are reached.
      c. The minimum DA temp will be calculated based on an outdoor air temperature reset. As the OAT drops from 65° down to 35° the minimum DA SP will reset from 6° down to 2° subtracted from the zone temperature.
   6. The maximum DA SP will be 95°.
   7. The need for zone cooling will lock out all heat valve control.

I. Hot Water Pumps
   1. The lead hot water pump shall be enabled whenever:
      a. A definable number of hot water coils (Initially 1) with control valves over 10% open.
      b. For freeze protection anytime outside air temperature is less than 38°F (adjustable.).
   2. To prevent short cycling, pump(s) shall run for a minimum time and be off for a minimum time (both user adjustable).
   3. When Run is no longer commanded, the Enabled Boiler(s) will be disabled and after a 5 minute time delay the hot water pump(s) will be disabled.
   4. Pump motor status will be monitored. If either pump has been commanded to run by the DDC system and the pump status is not indicated, the DDC system will send an alarm to the operator workstation.
   5. Hot Water Pump Lead / Standby operation
      a. The two hot water pumps shall operate in a lead/standby fashion.
      b. The lead pump shall run first.
      c. On failure of the lead pump, the standby pump shall run and the lead pump shall turn off.
      d. The designated lead pump shall rotate upon one of the following conditions (user selectable):
         - Manually through a software switch
         - If pump runtime (adjustable.) has exceeded an initial value.
         - Daily

- Weekly
- Monthly

6. Hot Water Pump Speed
   a. The Pump Speed is set via the heating loop differential pressure reverse acting PID controller. The heating loop differential pressure PID controller compares the heating loop differential pressure to the heating loop differential pressure set point and outputs a percent (0 to 100%) to control the pump VFD's. A Bias of 50% will be set to start the pumps initially at 30hz whenever system run command is given.
   b. The acceleration / deceleration rate of the VFD shall be set to 180 seconds and adjusted to provide smooth transition when pumps sequence on and off.
   c. When pumps are commanded to switch Lead Pump while pumps are running, the incoming lead pump will ramp up while the outgoing pump ramps down to minimize disturbance on the loop.

J. Boiler
   1. Emergency Shut Down Switches
      a. Emergency shutdown switches (if provided) located at each exit of the mechanical room will shut down Boiler(s) are hard wired to boilers and will shut down the boilers when depressed.
   2. Boiler Control
      a. Boilers will come with manufacturer supplied controls including operating limit switch and safeties.
      b. Once a HW pump has been enabled and its status is proven, the BAS will enable the boiler to operate on manufacturer installed controls.
   3. Provide communication via BACnet from the boiler controller to the central BAS allowing monitoring and alarming of selected points from the boiler system (points as determined by the owner). Coordinate with the process boiler supplier.

K. Split System Air Conditioning: Provide a wall mounted temperature sensor with high temperature alarm. On sensor alarms, send an alarm notice to the BAS.

L. Convectors:
   1. Warm-up Mode: Based on the space temperature, the optimum start / stop function will open the hot water valve so that the space temperature will reach set point (70-degrees F, adjustable) at the scheduled occupancy time.
   2. Occupied Mode: If the space temperature falls below the heating setpoint, open the hot water heating valve to maintain space setpoint.
   3. Unoccupied Mode: The hot water heating valve shall close. When the zone temperature decreases below the night low limit setpoint, the DDC shall index the unit to the morning warm-up mode. When the zone temperature has increased above the night low limit setpoint plus 5 degrees F, the DDC shall index the unit to the unoccupied mode.

M. Exhaust Fans.
   1. EF-10 through EF-15: Report fan status.
   2. EF-16: Start / Stop fan by temperature sensor (adjustable setpoint). Open motorized outside air damper on fan startup, close outside air damper on fan shutdown.

3.5 FIELD QUALITY CONTROL

A. Startup: Implement a logical step-by-step startup and checkout of the control system. In addition, startup assistance and coordination shall be provided during startup of the mechanical equipment. Startup shall be considered complete after the entire system is operating properly.
B. Self-commission all hardware and software provided for the project.
C. Completed field commissioning sheets shall be included with the final “as-built” O&M manuals. These sheets shall include validation check fields for all physical and LAN inputs and outputs and graphics for each operating unit or system within the facility. Each system and point shall be listed, using logical names for future reference by the owner.
D. Commissioning shall include calibration and verification of operation of each I/O and graphic field. Functional commissioning of software programming to meet sequences of operation as submitted and approved shall be verified on the field commissioning sheets.
E. At the completion of the job, in the presence of an Owner's representative, thoroughly check out the entire control system by simulating each control function and determine that the system performs in accordance with the Contract Specifications.

3.6 INSTRUCTION OF OWNER PERSONNEL

A. Provide complete list of system generated messages for system operation, including alarm messages.
B. Modify error message wording as required by the Owner's personnel.
C. Locate all control components for Operating Engineer.
D. The Owner will videotape the course for future use/training sessions. Submit an agenda listing topics to be covered during the training along with any literature to be used. Submit information to the Engineer and Owner for review/revision one month prior to project substantial completion and scheduling of the training course.

3.7 TRAINING AND TECHNICAL SUPPORT

A. Provide: 4 hours of training on the specific building controls
B. Training shall be oriented to make the owner proficient in the day to day use and operation of the DDC system. Additionally, the training shall include information specifically focused on showing the owner’s representative’s methods for troubleshooting the mechanical systems using the DDC system.
C. The contractor shall provide unlimited phone technical support to the owner’s representative during the one year warranty period. If the technical support location of the contractor is outside of the toll free calling area for the customer, the contractor shall have a toll free number or accept collect calls for the purpose of providing technical support.
D. In addition to required technical support and training Contractor shall make available access to factory approved training classes.

E. Classes shall be scheduled multiple times during the first year to allow flexibility for Owner's representative to attend. Tuition to these classes shall be included within the scope of this project. If course locations are more than 200 miles from the project site, cost of transportation, lodging and meals shall be included within the scope of this project.

3.8 RECORD DRAWINGS

A. Provide complete and accurate record drawings noting all deviations from the information furnished in the original submittals.

3.9 COMMISSIONING

A. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION

PART 1 - GENERAL REQUIREMENT

1.1 DESCRIPTION OF WORK

A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.
B. This section and all related sections shall be performed by a qualified Contractor as outlined in the specifications.

1.2 SECTION SCOPE

A. This section outlines the minimum requirements for equipment racks and cabinets.

1.3 RELATED SECTIONS

A. Section 27 06 00 – Data Center Core Specifications
B. Section 27 60 23 – Data Center Fiber Optic Backbone Cabling
C. Section 27 60 26 – Data Center Power Distribution
D. Section 27 60 28 – Data Center Pathways
E. Section 27 60 28.36 – Data Center Cable Trays
F. Section 27 60 48 – Data Center Vibration and Seismic Controls
G. Section 27 60 53 – Data Center Identification

PART 2 - PRODUCTS

2.1 TELECOMMUNICATIONS RACK

A. Existing racks shall be used.

2.2 TELECOMMUNICATIONS ENCLOSURES (Located in the Data Center)

A. Provide the following in quantities required to construct complete cabinet groupings as shown on drawings: ***Note that color for all exposed components is to be is to be Glacier White.***
   1. Telecommunications Enclosure, Chatsworth Part FF1J-111B-E60-B
   2. Telecommunications Enclosure, Chatsworth Part FF1J-111B-E61-B
   3. Cabinet doors shall be keyed alike. ***Lock set shall not be operable by CH751 key***.
   4. Cage Nuts, Chatsworth Part 12639-001, provide 4 per cabinet shown on drawing.
   5. Air Dam, Chatsworth Part 39130-E24, provide one per cabinet shown on drawings.
   6. Vertical Exhaust Duct, Chatsworth Part 39177-E07, provide one per cabinet.
   7. Bay Seal Kit, Chatsworth Part 39137-702, provide one per cabinet
   8. Bottom Panel, Chatsworth Part 39132-E02, provide one per cabinet
   9. Cable Management, Chatsworth Part 39129-E02, provide one per cabinet
   10. Snap in Filler Panel, Chatsworth Part 34538-E02, provide 3. ~~*per cabinet*~~
   11. Snap in Filler Panel, Chatsworth Part 34537-E01, provide 2. ~~*per cabinet*~~
   12. PDU Bracket, Chatsworth Part 39086-E02, provide one per cabinet

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Racks shall be firmly affixed to the concrete slab using expanding anchors and Grade 5 bolts.
B. Top of rack shall be firmly affixed to ladder tray by means of a mounting plate as detailed in Section 27 11 23.
C. Rack shall be bonded to adjacent assemblies as detailed in Section 27 05 26.
D. All metallic components shall be bonded as per 27 05 26.

3.2 CABINET ASSEMBLIES

A. Cabinets shall be assembled in groups as depicted on drawings. Cabinets shall be bolted together with a minimum of four attachment points per side.
B. Sides shall be required on the end of each group only with the central portion of the group being open.
C. Cabinets shall be secured to the slab beneath the raised floor by means of UniStrut® and Grade 5 (or greater) all-thread. End cabinets shall be anchored in a minimum of four places with central cabinet requiring a minimum of two anchor points.

END OF SECTION

CLASSROOM AV SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This project will include design and installation of classroom A/V Systems. Components may be those currently installed, furnished by this contract or Owner Furnished, Contractor Installed as specified or as shown on Drawings.

1.2 RELATED SECTIONS

A. Section 27 0000 – Communications
B. Section 27 0500 – Common Work Results for Communications
C. Section 27 0513 – Communications Services
D. Section 27 0526 – Grounding and Bonding for Communications Systems
E. Section 27 0528 – Pathways for Communications Systems
F. Section 27 0528.29 – Hangers and Support for Communications Systems
G. Section 27 0528.33 – Conduits and Backboxes for Communications Systems
H. Section 27 0528.39 – Surface Raceways for Communications Systems
I. Section 27 0800 – Commissioning of Communications

1.3 CABLE RACEWAYS

A. All raceway routing and mounting height information shall be coordinated with the Electrical and Architectural Drawings.

1.4 VIDEO PROJECTOR SYSTEMS

A. Classroom Projectors – Owner Furnished, Contractor Installed.

B. Classroom Projector Mounts – Contractor furnished and installed.

C. Classroom AV Cabling, Contractor Furnished Contractor Installed.

1.5 SYSTEM CONTROL

A. The operation shall be automated through the Owner provided classroom computer and projector remote control and shall not, typically, require adjustments or user intervention.

B. Audio Visual Playback – System shall be capable of playing DVD/PC based media, from Owner provided source equipment.

PART 2 - PRODUCTS

2.01 PROJECTOR MOUNTS AND INSTALLATION

A. Contractor is to install Owner Furnished ceiling mount projectors, in locations as called out on Drawings.

B. Contractor is to provide and install Chief Manufacturing part # KITPF012018 at each projector location where the projector is being placed in the hard surface rather than drop in ceiling tile.

C. Contractor is to provide and install Chief Manufacturing part # KITPS003 at each projector location where the projector is being placed in drop in ceiling tile.

2.02 PROJECTOR VIDEO CABLING

A. Install video cable as shown on the Drawings. Field verify final placement.

B. Contractor is to provide and install one Quiktron Rapid run cable # 41183-050 at each classroom with a projector.

C. Provide one Quiktron Wallplate # 42423 at the presenter location at each classroom with a projector at locations indicated on the drawings.

D. Provide one Quiktron Flying Lead # 42417 6’ active HDMI lead at the projector end of cable.

E. Hubbell is an approved alternate to Quiktron.

2.03 USB CONNECTIONS

A. Provide USB 2.0 connectivity between the presenter location and the projector.

2.04 PATCH CORDS

A. Provide the following patch cords:

1. USB Patch Cords

Length	3’
Quantity	25

2. RCA Stereo Audio Patch Cords (Red/White connector)

Length	7’
Quantity	25

3. HDMI Patch Cords

Length	7’
Quantity	25

PART 3 - EXECUTION

3.01 GENERAL

A. A complete system shall be installed in strict accordance with manufacturer's recommendations.

B. All wiring shall be installed in raceways within walls where at all possible. Surface mounted raceway is not permitted.

C. All wiring shall be plenum rated, where routed through plenum ceiling areas.

3.02 CABLE PLACEMENT AND PATHWAYS

A. All cables must be completely enclosed (or above the dropped ceiling where applicable) except for the patch cables that transition between the Quiktron faceplate and the projector.

B. Cables may be run in the area above the dropped ceiling. In such areas, cables are to be supported by Caddy® fasteners / hangers at intervals not exceeding 48 inches. Extra slack shall not be “stored” exposed at the projector.

3.03 INSPECTION AND TEST UPON COMPLETION

A. Check-out and final connections to the Audio and video systems shall be made by a factory trained technician certified by the manufacturer of the products installed. In addition, factory trained technicians shall demonstrate operation of the complete system and each major component to the Owner.

B. System field wiring diagrams shall be provided to this subcontractor by the system manufacturer prior to installation.

C. Training – this contract shall provide training for not less than three District staff members. Training will include all aspects of the system as well as complete documentation covering all components requiring operator control or intervention.

3.04 SYSTEM DOCUMENTATION AND AS-BUILTS

A. Contractor shall provide a complete set of system documentation bound into a three-ring manual with a table of contents and tabs for each piece of equipment. As-built documentation shall be generated in AutoCAD® version 2010 or later and provided in hard copy as well as electronically on CD.

3.05 WARRANTY

A. All materials and installation shall be guaranteed for a minimum of one year from installation. Warranty work will be performed “on-site” at no cost to the Owner.

B. Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall include part numbers and names, addresses, and telephone numbers of parts source. Final payment shall not be made until operational manuals have been received.

C. Upon completion of the installation of the equipment, the Contractor shall provide to the Owner or the Owner’s Representative a signed statement from the equipment supplier that the system has been wired, tested, and functions properly according to the specifications.

D. Nothing herein contained shall be construed to relieve the Contractor from furnishing a complete and acceptable electrical wiring system in all its categories. The Owner or the Owner’s Representative will condemn and reject any materials or labor which are or may become detrimental to the accomplishment of the intentions of these specifications.

END OF SECTION 27 4100